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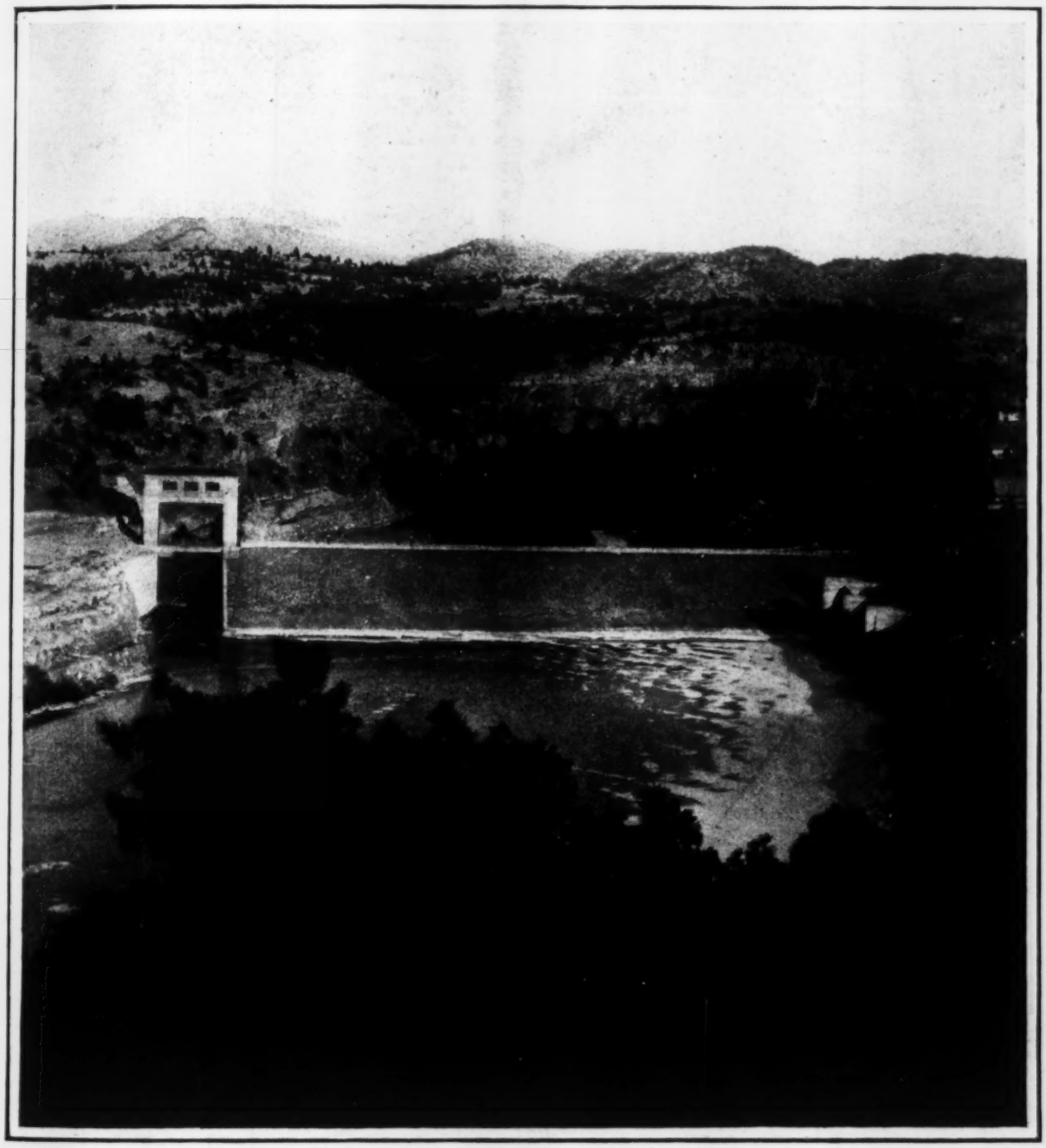
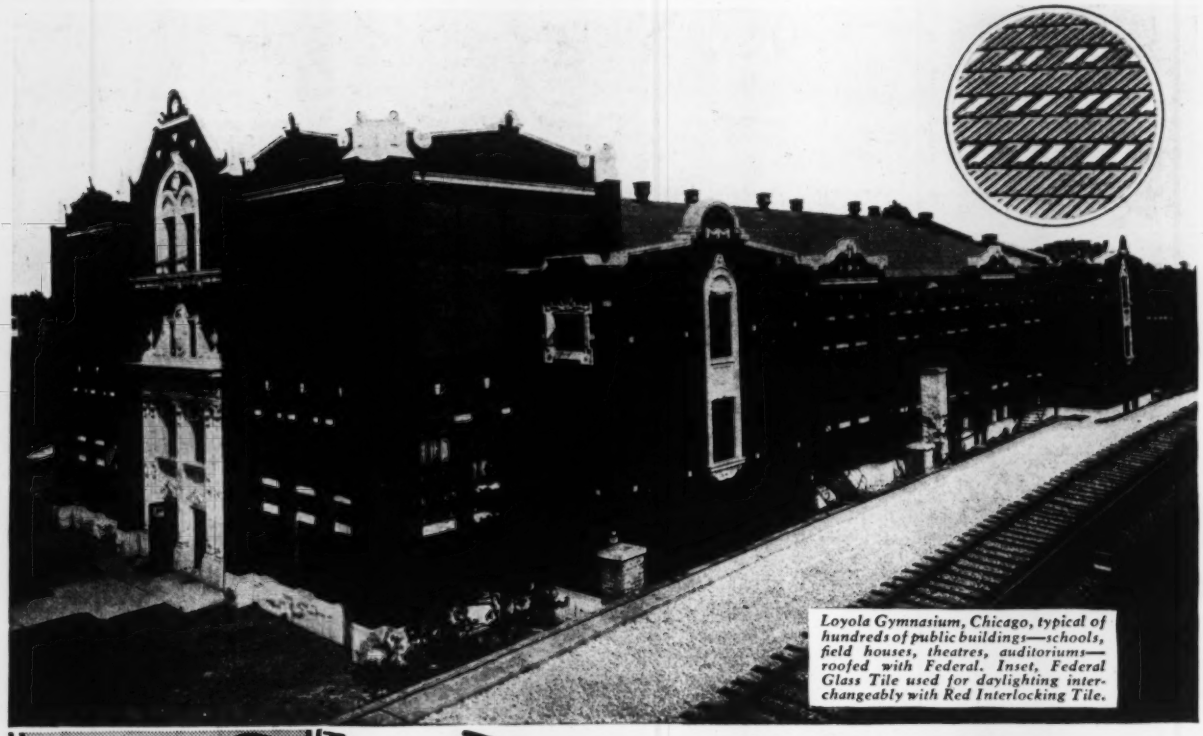
Engineering News-Record



Recently Completed Semi-Hydraulic Fill Dam
on the North Platte River
in Wyoming



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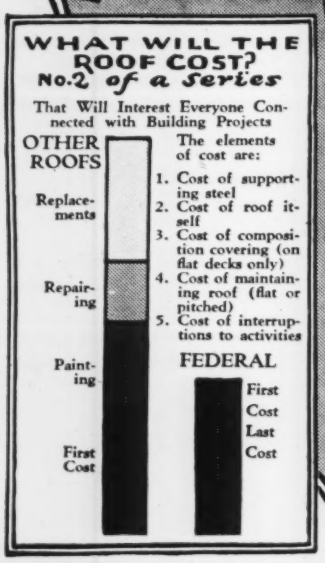
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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

WILLARD CHEVALIER
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F. E. SCHMITT
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A Consistent Record

PASSING months bring no improvement in the unsatisfactory situation as to automobile headlights. Laws prohibiting blinding lights are on the statute books, but they are not enforced, and so the night traveler on the road continues to be exposed to a serious danger against which he should be protected. Technical shortcomings of the art are not responsible for the prevalence of blinding lights. There is ample knowledge of how to build and attach headlights that will not throw out a blinding glare, as is proved by the large number of vehicles that carry such lights. Lack of law enforcement is the sole responsible cause. State motor vehicle departments are making a consistent record of failure in law enforcement in this important element of road safety.

Honor to a Prophet

CONTRARY to the old rule as to prophets and their honor, Dr. Isaac Cline of the U. S. Weather Bureau has been awarded timely honor and distinction by his fellow citizens in New Orleans for long-time fruitful service as a prophet of floods. Last week our news columns told of the testimonial presented to him by the people of the city. One of the things he did to earn this reward may be understood in part from his condensed story of overland flood forecasting last spring, on another page. His calculations and the resulting prompt warnings saved a large number of lives and lessened the hardships and misery of many thousands. Not only last year did he serve his community, however; for years he has been the dependence of the entire lower river in the matter of flood forecasts, in addition to serving as special prophet to the Gulf Coast whenever a tropical hurricane was in prospect. Whether the method of prediction employed in these services was forecasting or prophesying—arithmetic or scientific intuition—is perhaps not material, though we suspect that at least some of the latter was involved. It is certain, at all events, that the results were of remarkable value to all the people of the lower river.

Protecting Timber Structures

EXCEPT fire, nothing attacks timber structures with such destructive effect as termites and teredos, one on land and the other in water. Fortunately the territorial range of each is limited; yet the range of either type is sufficiently extensive to become an important factor in the design of engineering structures in many parts of this and other countries. Termites must be reckoned with in the southerly and Pacific Coast states of this country. Elsewhere in this issue Thomas E. Snyder, entomologist of the U. S. Department of Agriculture, gives some practical advice as to methods of combating them. One point which he makes is worth emphasizing—namely, that the type of construction is not so important as is the thoroughness with which preventive measures are carried out. Failure to isolate some obscure corner of a building properly from moist ground may provide the one point through which the termites, all unknown as far as outside appearances are concerned, may honeycomb the greater part of the timber in the structure. Careful construction and eternal vigilance are the price of immunity from attacks of these destructive insects.

Concealed Values

FROM the earliest days, man's activities as a builder have been powerfully influenced by the problems of constructing satisfactory foundations. A site was good if it adapted itself easily to building, and was bad if a foundation proved troublesome and uncertain to construct. This matter of the dependence of value of site upon subsurface conditions still has large importance, in spite of the high degree of modern skill in foundation work. Not only the general nature of the ground is involved but also the matter of local obstacles discoverable only by exceptionally thorough exploration. An instructive instance is found in the case of the newspaper building reported in this issue (p. 280). The site here was a former waterfront, and during construction some unmanageable crib bulkhead work was encountered in one part of the site, with the result that it had to be bridged over, at a considerable extra cost. It is possible that if the presence of this obstacle had been known in advance its influence on the suitability of the site for the heavy structure intended would have been recognized and another site chosen. The value of ground for building purposes thus may not be altogether at the surface, but part of the value, positive or negative, may be concealed below ground.

Bad Legislation

REASONS for the resignation of Sullivan W. Jones as New York state architect, chronicled in this week's news pages, are not hard to find. During the past year the state architect has been legally, if not actually, subordinate to the Department of Public Works, though he remained functionally independent in a large part of this work. Now Mr. Jones resigns to fight open-handedly against proposed legislation that would give the superintendent of public works sole control over architectural matters pertaining to public building. The injustice of the proposed legislation is obvious. Its intent is a blow at the fundamental principles underlying all the professions—absolute freedom of operation within limits which the profession itself specifies. Subordinating two bureaus which in their essential nature are concerned with design and construction to one which is more concerned with operation is bad organization. Now the legislators, having already begun a disruptive process, are carrying it farther. Instead of separating the functions of the state

architect, the state engineer and the superintendent of public works, they seek further to confuse the issue by "simplified" organization. The fact that there has been friction between the state architect and the superintendent of public works does not alter the situation as regards this proposed legislation. It is vicious and should be defeated, and engineers and architects alike should exert all possible influence against this threatening of their professional integrity.

A Structural Stepchild

APART of the modern building that is not receiving its share of thought by structural engineers and architects is the exterior curtain wall—that assemblage of brick or tile which forms the essential protection. A corollary to this lack of thought is the scarcity of literature and published data on the subject. An article in this issue on methods of erecting weatherproof exterior curtain walls touches one important factor. But it is only a beginning. Fire resistance, heat insulation, load-bearing ability, all largely inherent in the material and structrue of the wall, need to be discussed. The fact that some tests have been under way for several years and that they are being extended, on the initiative of manufacturers, is encouraging. But obviously tests will be of value only as the results are promptly published and exposed to the light of discussion and criticism. The special feature discussed in this issue, weatherproofing, is dependent mainly on proper erection methods, and information on this phase of the subject must come from the field. Here, as in the case of laboratory tests, the exterior wall has not had the benefit of such discussion as is accorded other structural problems. The exterior curtain wall should cease to be regarded as a stepchild. As much as the framework it is a vital component of the modern building.

Faith in Shipping

A SHORT time ago Edward N. Hurley put forward an attractive proposal for establishing the American merchant marine on a firm footing. He proposed that part of the capital burden be assumed by the government through loans at a nominal rate of interest. Somewhat along the same lines was a subsequent offer from interests that proposed to put four-day transatlantic steamers on the sea if the government would underwrite a considerable part of the investment at an interest rate corresponding to that paid for Treasury loans. Neither of these plans has yet had a favorable hearing in Congress, but this body has so definitely expressed its faith in an American shipping future as to warrant the hope that some effective measure for the development of shipping may be enacted. The Senate, which has just passed the Jones shipping board bill, thereby gave unmistakable evidence of this faith. Such belief in the importance of shipping is the encouraging aspect of a situation that otherwise is unsatisfactory because of complete disagreement of views. The President in asking for early sale of the government-operated shipping lines apparently aimed at nothing other than abandoning the operation of business ventures on the part of the government. The Senate, however, has gone on record as unwilling to follow his suggestion except under rigid safeguards to assure that the American flag will be kept on the seas. The Jones bill, before it passes the House, will undoubtedly lead to more active discussion of other methods of maintaining a merchant marine than that of government ownership and operation, and there should be opportunity for thorough study of the two proposals mentioned. The main factors of the problem are difficult to harmonize. Despite widespread demand for a merchant marine, it is evident that under private financing it is almost hopelessly at a disadvantage. Yet our national business principles are against governmental conduct of a trading enterprise. A solution that involves government loans or their equivalent is by no means free from similar objection; it may, however, prove the only present expedient capable of bringing about the desired result.

Technical Recognition

EIGHT and ten years ago it was the common thing for engineers in average position to pay a great deal of attention to "welfare"—a term which, baldly speaking, meant more money in the pay envelope. That was in the heyday of the American Association of Engineers, with its 24,000 members at that time. What has become of the higher-pay enthusiast? Has he finished the "education" of employers? Has the payroll been jacked up to his satisfaction in enough cases to make unnecessary further organization, or at least talking about it?

It is a fact that municipal engineers in New York, Chicago, San Francisco and a few other cities have unionized, and unions usually act rather than talk, but there are engineers in hundreds of smaller municipalities, in thousands of industries and utilities, who are not in the unions. Are these men inarticulate from lack of organization or has their pay been boosted to a point where further "education" is unnecessary?

As one instance from which certain deductions may be drawn there comes to hand the published detail budget of the Sanitary District of Chicago. The salaries noted therein are such as to attract the best men. No talk of strikes, of disgruntled employees or of incompetency has come from that organization for many years. While civil service does not exist, yet tenure of office for the competent engineer is probably far more stable than in the civil-service-protected positions of the city of Chicago, where recently an engineer generally recognized as of high competence was given 35 minutes to resign or be suspended because it was an "administration" matter.

But it was salaries rather than stability that started the present train of thought. The Sanitary District chief engineer is set down at $20,000, the principal assistant chief engineer at $12,000, the assistant chief engineer at $11,000, the sanitary engineer at $11,000, the construction engineer at $7,800, and the director of health at $15,000. Heads of the following divisions receive $7,200: general engineering, structural, architectural, sewage-treatment plant design, mechanical, sewer design, and laboratory and sewage-treatment plant control.

Several other divisions are headed by assistant engineers receiving from $4,500 to $6,000. Then there are more than seventy-five additional assistant engineers with pay ranging from $3,000 to $5,000. A very few with that title receive $2,700. No technical employees, junior engineers, inspectors, rodmen, draftsmen, tracers, etc., receive less than $2,400 and few less than $2,700, since it has been made the policy to keep the lower-grade technical staff above or at least on a par with the non-technical force.

The total 1928 budget of the Sanitary District is $58,400,000, of which $11,000,000 is for fixed charges, $40,000,000 for the engineering department, $5,200,000 for permanent plant and structures and the remainder for

miscellaneous. Of the $40,000,000 for engineering, 8.8 per cent ($3,550,000) is for personal service. About $20,000,000 is all that can be spent in 1928, it is estimated, but the personal service figure will remain and in consequence the percentage will be about 15 per cent.

The Sanitary District raised salaries all along the line this year, but for several years past it could probably lay claim to leadership in liberality to a technical staff. Just how much the "education" of the past decade has had to do with this policy is hard to determine. At any rate, here is a shining example, which might well be emulated, of municipal appreciation of the value of technical services without the stress of union methods.

Water-Storage Stand-by Plants

WHEN stand-by service is needed in a hydraulic power system, precedent dictates the use of steam plant. Stand-by plants of some sort are economic necessities where peaks must be carried or insurance must be provided against failure of a transmission line; whether steam is always the best power for such plants is an open question, however. With favorable topography and a low-level water supply the European expedient of pumping water into a storage reservoir for use at time of peak loads may have a decided advantage over a steam plant. The method is not entirely unknown in this country, for it was used as long as twenty years ago at the Colgate plant of the Pacific Gas & Electric System in California and is to be used in the Rocky River plant now under construction in Connecticut.

As applied to stand-by service, such a scheme calls for a plant in which off-peak power could be used for pumping water into some convenient high-level reservoir, whence it would later return to hydraulic turbines to generate power at times of peak loads. The efficiencies of motors, pumps and hydraulic turbines have all been brought up to a point where the losses in plants of this kind need not be great. No fuel storage or fuel delivery system would be required; where natural conditions are favorable the first cost would not be high, and in general the advantages of motor as compared with steam operation would be obtained.

Water-storage stand-by plants would not be wholly independent of transmission lines, and in this respect the steam stand-by can perhaps claim some slight superiority. But today, when every city is served by an interconnected network of power lines, the probability of complete and prolonged isolation of sources of hydro-electric power is very remote.

Perhaps one of the greatest advantages of the hydro-electric stand-by would be the very short time required to put the plant into service in an emergency. The plant could start with all equipment "cold" and could be synchronized with the distributing system in a few minutes, whereas the best a steam plant could do would be several hours. Because of the delay in getting boilers hot, the more important steam stand-bys are kept under steam at all times, necessitating a corresponding attendance and operating cost. Such cost might be entirely eliminated, and in any case would be less, if water power were substituted for steam in this service.

Obviously, a stand-by plant using water power would be practicable only where natural conditions, particularly topography, favored a low-cost installation, but where such conditions obtain, the water stand-by warrants consideration.

Equipment Consciousness Lacking

EXAMINATION of three very new books on construction, leading to the search of a considerable shelf of such books, discloses that not more than one in ten of them mentions construction equipment otherwise than incidentally. Not that these books do not contain many illustrations and descriptions of machines used in construction operations; there is indeed much description of this kind, but it has the smack almost invariably of incidental cataloging. Only rarely is equipment majored in importance with excavation, concrete work, steel erection, etc. In brief, equipment planning, selection, co-ordination, operation, upkeep and accounting as functional parts of engineering construction are not recognized generally by engineering book writers. In this respect engineering books represent rather truthfully, we think, the engineer's general lack of equipment consciousness—a defect that becomes increasingly serious as time goes on.

Included among engineers in this generalization are contractors. Equipment economics and engineering are not understood by many of them. They, however, are very pronouncedly doing something gropingly toward an understanding. Second in importance only to surety bonding, accident prevention and quantity survey at the annual convention of the Associated General Contractors a few weeks ago, papers and discussions on equipment depreciation, obsolescence and cost accounting occupied a large part of the program. The interest was general, particularly among the highway and public-works contractors. Back of it, however, the discussion indicated, there lay primarily anxiety to know equipment expenses in order to figure the depreciation allowance that would meet the requirements of the federal income-tax bureau. There was very much less indication that consciousness of equipment as the major investment and operating cost item in present-day public works construction was seriously appreciated.

Contractors, like engineers, then, have not yet become accustomed properly to evaluate the equipment factor in the problem of construction economics. There are, of course, individual exceptions, and a few association groups are beginning to develop comprehension. The pressure of equipment cost is forcing consciousness upon them of its commanding magnitude. But broadly there has yet to come a recognition of construction equipment such as the manufacturer has of factory equipment. Just as manufacturers in most lines of industries have compilations of records on which to base appraisals of equipment life, efficiency and rental costs, so must constructors have them. Then will the equipping of construction work become in true sense construction plant engineering. This is the big objective of the future in construction and to reach it, high engineering talent and vision will have to be exercised.

Thus far neither engineers nor contractors in association have done anything worthy toward accomplishing it. A committee of the construction section of the American Society of Civil Engineers has something of the task in hand. There are committees of the Associated General Contractors within whose functions the task might lie. They have done little with it. There is not today any assembled knowledge upon which construction can call for direction in planning the major function and expense of its business—plant planning and cost—and there is no well-directed, purposeful association effort being made to secure it.

Building the Guernsey Irrigation and Power Dam

Semi-hydraulic Method of Construction Adopted for Gravel-Fill Dam Built on Permeable River Bottom—Material Dumped From Trestles Was Sluiced Into Place

By F. F. Smith
Construction Engineer, U. S. Bureau of Reclamation,
Coalville, Utah

With the completion of the Guernsey dam, on the North Platte River, in Wyoming, an important factor is added for the control and conservation of this river, which supplies the North Platte federal irrigation project, comprising 237,000 acres of irrigated land in Wyoming and Nebraska. Inflow below the Pathfinder Reservoir, the main storage reservoir for the project and 160 miles upstream, will now be conserved; closer control of water will be effected for the two large main canals diverting at Whalen dam, 9 miles below the new works, and a 90-ft. head will be created for power development. The impounding reservoir of 72,000 acre-feet capacity can be filled several times annually, thus providing supplemental water for irrigation and augmenting the normal river flow for power purposes during the non-irrigation season.

Design of Dam—Wash borings showed that bedrock was below reasonable depth, although it was exposed above the river at each abutment. A gravel and rock-fill dam was then designed with an assumed percolation factor of 8 to 1, which was changed during construction to 9 to 1. This dam is a composite structure of loose rock and sluiced gravel and clay, with a puddle core extending from 30 ft. below the river bed to the crest. Its construction is shown in Fig. 1, and the general design in Figs. 2 and 3.

The dam height above bed of stream is 105 ft., the crest length 560 ft., and the base thickness 1,000 ft. The 26-ft. crest forms a driveway, with a parapet 3 ft. high on the upstream side and a 15-in. curb wall on the other side. The 1:3 upstream slope is protected by 3 ft. of riprap. For 30 ft. below the crest the downstream or rockfill portion has a slope of 1 on 2 and then 1 on 8 to a depth of 75 ft., beyond which it is approximately level for 160 ft. and has then a slope of 1 on 3 to the river bed.

Construction of Dam—The gravel and clay fill of the dam body was placed by the semi-hydraulic method, being transported from borrow pits by steam locomotives and 4-yd. cars, dumped from trestles and then sluiced toward the center by a hydraulic giant mounted on pontoons and moving back and forth in the central pool. This pool was regulated by pumping water from the river through a 6-in. pipe. The beaching down of the dumped material and the pool-regulating stream are shown in Fig. 1. The trestle arrangement and progress of the fill, with size and slope of the central pool, are shown in Fig. 3. A sufficient quantity of clay was dumped from both sides of the pool to supplement the fines contained in the gravel so as to provide an impervious puddle-core center.

A slackline bucket excavated the puddle trench below the river bed to a 10-ft. bottom width and slopes of 1 on $1\frac{1}{2}$. This trench was not unwatered, as the sand and gravel took the prescribed slope under water. After completion of the trench, the clay was dumped on the upstream side and sluiced into place. Three concrete cut-off walls 5 ft. high were constructed on each abutment from 15 ft. below the river bed to the top of the dam. Puddle clay was used to fill the trenches and to cover the walls to a depth of 5 ft. The materials in the dam include 300,000 cu.yd. of sluiced gravel, 15,000 cu.yd. of gravel sluiced into the rock base, 50,000 cu.yd.

FIG. 1—POND OF GUERNSEY DAM, WYOMING
Trains dumped material from trestles on each side. Hydraulic giant on raft washed material into place.

of selected clay and 147,000 cu.yd. of rock excavated from the tunnels and spillways, making a total of 512,000 cu.yd.

A highway led to the site, 3 miles from Guernsey, Wyo. The contractor constructed a spur from the Chicago, Burlington & Quincy Railroad to the top of the dam, with a branch across the river to the borrow pits and concrete-mixing plant, about ¼ mile from the dam. A geared engine operated the heavy grades on this spur. At the gravel pit was the screening and mixing plant. As the pit material contained an excess of sand, all the oversize was put through a crusher. Material was moved to the grizzly and crusher by a cable-operated scraper and then to the top of the screening plant by a belt conveyor. A 1-yd. mixer was placed under the sand and gravel hoppers. Compressed air for drills and power shovels was supplied by two air-compressors of 1,300 cu.ft. capacity.

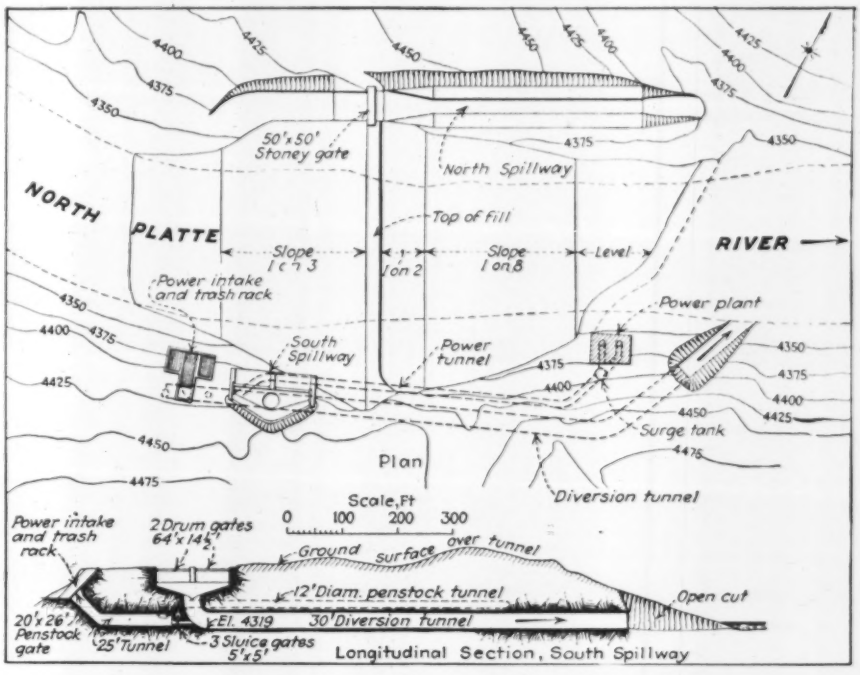


FIG. 2—GUERNSEY DAM AND POWER DEVELOPMENT

Diversion Tunnel—For temporary bypass of the river, a tunnel was driven through the solid rock of the south abutment, 25 ft. in diameter for 273 ft. and 30 ft. for 797 ft., making a total length of 1,070 ft. The rock was red sandstone and limestone, with occasional streaks of low-grade iron ore, which caused considerable trouble by sloughing. An 18-in. concrete lining was placed for the entire length.

Two air-operated shovels working from both portals loaded the rock, 36,000 cu.yd., into 4-yd. dump cars. A top heading 10 ft. high left a bench about 10 ft. long and 11 ft. high, which was shot each round by lifters. The floor of the first pass through the tunnel was left 12 ft. above final grade, and was later removed by a separate pass the full length. In the top heading each round of shots pulled about 8 ft. of rock. The powder consumption was 3¼ lb. of gelatin dynamite per cubic yard. Electric detonators were used. Overbreak of 8 per cent of the total tunnel area made the concrete lining 47 per cent in excess of the 18-in. thickness designed.

Concrete was placed entirely by hand methods and chuting, except that the closing section was placed by a concrete gun. Two 20-ft. lengths of traveling jumbo forms for the 25-ft. diameter were used on tangents, the forms on curves being built in place. Five 20-ft. lengths of traveling forms were used for the 30-ft. tunnel and concreting was started from both ends. These forms were carried by double-flanged wheels on steel rails, but later 12x12-in. timbers on concrete piers were used as a skidway. Fig. 4 shows the jumbo form collapsed for moving ahead. The crown section was lowered on house jacks and the side-wall sections were pulled in by chain blocks moving on dollies supported on the timbers.

Concreting the 30-ft. section was assisted by an elevator midway in the tunnel, operated by the drum of one of the power shovels. Concrete was hauled in specially designed 1-yd. cars and hoisted to a trestle giving minimum clearance below the tunnel crown. The cars were pushed along the trestle to chutes that emptied into the jumbo side forms. After these walls were poured, the crown forms were placed in the 3-ft. sections and the concrete was shoveled from the cars into the crown and rammed back to place. The floor section was left until the sides and crown were placed, the bottom being then cleaned out and a track placed on a low trestle. About 4 ft. of floor was left out at each trestle bent and poured later, as the track was removed.

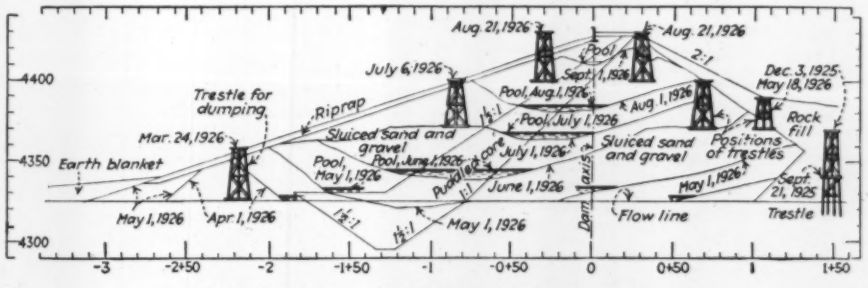


FIG. 3—EARTH-FILL DAM, GUERNSEY, WYO.
Showing successive positions of dumping trestles and sluicing pool.

Diversion Tunnel Closure—After the north spillway had been completed far enough to handle the river flow, the diversion tunnel portal was permanently closed by a concrete arch from the top to within 5 ft. of the floor of the intake and about 1 ft. above the surface of the water

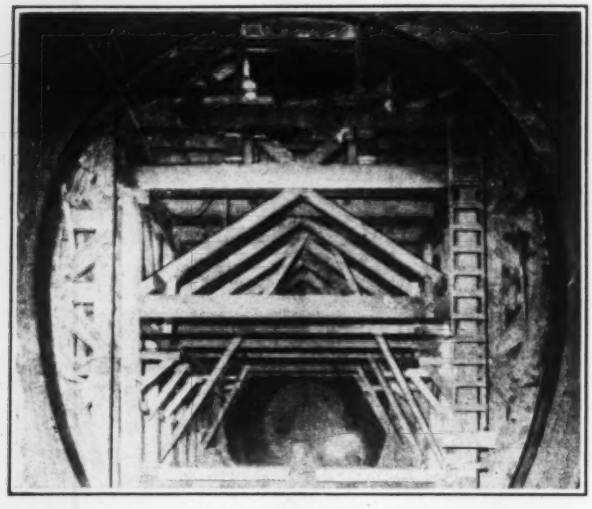


FIG. 4—FORMS FOR LINING TUNNEL

in the tunnel. This 5-ft. opening was then closed by placing 12x12-in. timbers vertically, with the lower ends inserted in a groove left in the intake floor. Two hinged gates 3x6 ft., weighted with steel rails (Fig. 5), made the final closure, cables being cut and the gates allowed to fall to place. Puddle material was later dumped in front of the portal to seal off any small leakage.

Intake and Desilting Chamber—Water for power purposes passes into the closed diversion tunnel 105 ft. below the portal. The intake is controlled by an electrically operated Stoney roller gate 20x26 ft., set at an angle of 45 deg. This gate is protected by a trash rack structure having an opening of 4,460 sq.ft., which will admit a sufficient flow of water under the worst ice and driftwood conditions that are expected.

Two concrete plugs were constructed in the diversion tunnel, one just above the power intake and the other just above the entrance from the south spillway, thus isolating a section of the tunnel for use as a desilting chamber. The power water at maximum discharge passes through this chamber with a maximum velocity of 2.9 ft. per second to the concrete-lined power tunnel, which takes out near the roof. Silt accumulation is sluiced into the 30-ft. section of the tunnel through three hydraulically operated gates, 5x5 ft., in the lower plug. Grout pipes were left through the tunnel lining when the concrete was placed in the desilting chamber and later these holes were extended 10 ft. into the solid rock by drilling through the pipes. The grout forced into the rock behind the concrete lining amounted to only 15 cu.yd. for a length of 128 ft., or 0.04 ft. per square foot of rock surface.

Spillways and Gates—A combined spillway capacity is provided for 82,000 sec.ft., or nearly four times the highest recorded flow of the North Platte River, which was 20,800 sec.ft. in June, 1917. Records were studied back to 1909, when the main storage reservoir above was completed. As the railroad is close to the maximum flow line on the south side, an automatic spillway of large capacity was necessary. This is of the drum-gate type. This south spillway empties into the 30-ft. section of the diversion tunnel through a shaft 31 ft. in diameter. Two drums 14½x64 ft. were installed, having a maximum capacity of 30,000 sec.ft. with the reservoir full. This structure is shown in Fig. 6, with the far gate partly raised for a test to determine the watertightness of the seals by pumping water into the drum chamber beneath the gate. This is the fourth installation of this type of gate by the Bureau of Reclamation. Its operation was described by Julian Hinds in *Engineering News-Record*, June 25, 1925, p. 1046.

The 31-ft. shaft was constructed as a riser when the diversion tunnel was built, being carried up 31 ft. above the roof. Timber trusses at the top supported the power shovel when the outside spillway excavation was made. For concrete placing and gate assembly, a cableway of 300-ft. span was located over the center of the drum gates and operated from a power shovel under the head tower.

The north spillway is a concrete-lined channel 585 ft. long, with a bottom width of 25 ft. and slopes of 2 on 1, 40 ft. high, cut through the solid rock. Its maximum discharge capacity is 52,000 sec.ft. Irrigation flow is controlled here by an electrically operated Stoney gate 50 ft. in height and 54 ft. 7½ in. wide. The gate leaf, weighing 434,000 lb., is counterweighted by fifteen concrete blocks 34½x39 in. and 8½ ft. long, with an 8-in. H-beam passing through the center and connected to a structural steel base for support. Each counterweight weighs 187,000 lb.

This gate leaf is built up of twelve plate-girders 6 ft. deep, laid horizontally, with diagonal bracing, and covered on the water side by a $\frac{9}{16}$-in. skin plate. The sliding friction is taken care of by six sets of rollers on either

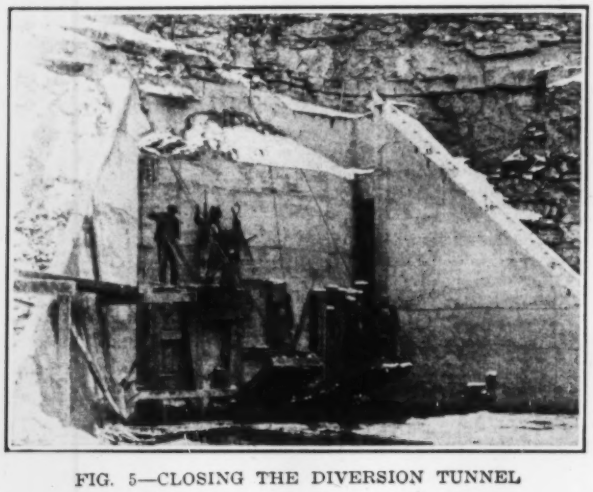


FIG. 5—CLOSING THE DIVERSION TUNNEL

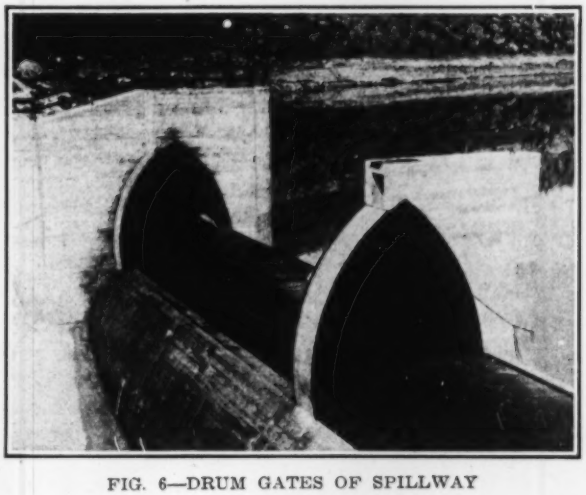


FIG. 6—DRUM GATES OF SPILLWAY

side, riding on an H-beam. Any deflection in the girders that would tend to throw the rollers out of plane is taken care of in the flexibility of the web of this H-beam track. The side seals on the upper side of the leaf are of brass pipe moving on lugs riveted to the skin plate. This pipe is forced by the water pressure against the 6x6-in. seal angles embedded in the concrete. The operating chain passing from the gate and over the hoists to the counterweight stems is 66 ft. 2 in. long and weighs 283 lb. per lineal foot. It has 5-in. high-tensile bronze pins 17 in. long, spaced 10 in. c. to c. and connected by four high-carbon steel plate links 1x9-in.

Assembly of this gate leaf was started from a trestle, designed to take the total weight and built 15 ft. above the channel floor, to give clearance in case of high water. The bottom girder was placed with the upstream edge resting on an H-beam which had been accurately lined and leveled. When three girders had been placed, the cross-bracing and skin plate were service-bolted and then riveted. By this method the rivet holes were matched accurately when the top sections were reached. Riveting of the end girders was kept one section below that of the skin plate.

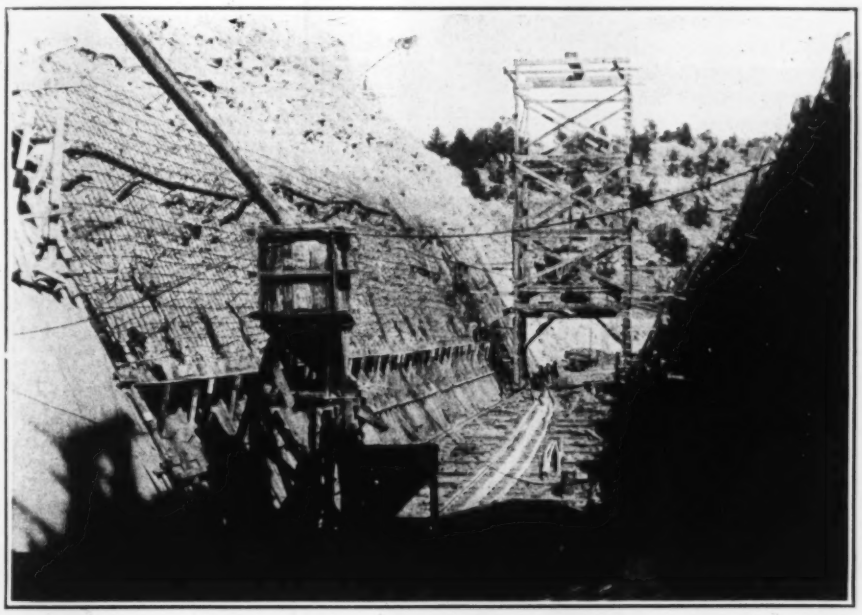


FIG. 7—LINING THE SPILLWAY CUT

For transferring the weight of the gate to the counterweights, the counterweight wells were filled with sand sufficiently to allow the chain connection to be made. When the chain was connected to the counterweight stem, the sand was removed from the bottom of the well by an air jet, allowing the counterweight to settle slowly until it took the full weight of the gate. Then the hoists raised the gate and the trestle support was removed. A concrete bridge with 16-ft. roadway over the spillway channel provides for a highway across the dam.

A counterfort retaining wall with a maximum height of 66 ft. forms the side of this channel at the gate. Tension bars of 1½-in. square steel in the backs of the buttresses were placed full length to avoid lapping or welding. The foundation rock along the top of the retaining wall, across the channel under the gate and behind the wing wall on the north side was grouted to avoid leakage from the reservoir. Concrete for the spillway channel lining was hauled from the mixing plant and chuted to a hopper in the bottom of the cut for filling 1-yd. cars, which moved to the traveling hoist, where they were raised to chutes for pouring into the side forms, as shown in Fig. 7.

Forms for this work were of the cantilever type, 4 ft. 8 in. high; the two 2x6-in. legs, set 1 in. apart, extended down over the previous pour and were bolted down by 1-in. tapped bolts connected to ½-in. rods extending to within an inch of the concrete surface. By this method, forms were quickly stripped and raised. A setting of these forms 150 ft. along the spillway channel constituted an eight-hour pour. The two sides were worked alternately, so that a pour was made on the day shift and the forms moved by the night shift. In this way forms were left for 24 hours, which proved to be sufficient during summer time for concrete on a slope of 1 on 2. The average thickness of the lining was 18 in.

Anchor bars 1¼ in. square and spaced 10 ft. c. to c. both ways were set 5 ft. into the rock and hooked over 6 in. under the concrete surface. These bars supported the ¾-in. reinforcing bars, spaced 15 in. c. to c. both ways. A 4-in. tile drain was laid every 10 ft. from the top of the lining to the 30x30-in. manway drain under the floor, and ran from the downstream side of the gate to the outlet end, where it passed through the right bank.

Power Penstock — The power penstock takes out from the top of the diversion tunnel and runs parallel to it, 42 ft. c. to c. It is a 12-ft. tunnel through solid rock, 662 ft. long, lined with 10 to 15 in. of plain concrete. All rock excavation was taken out through the lower portal, the 4,160 cu.yd. being deposited in the rockfill portion of the dam. Two shifts were employed; the drilling and shooting was done by the day shift and the mucking by the night shift. The average daily progress was 5.9 ft. Hard red sandstone was encountered, with occasional streaks of a low-grade iron ore. The resulting overbreakage was 13.5 per cent on the rock area and 42.8 per cent on the concrete lining, computed on the basis of 15-in. thickness. A 1-yd. concrete gun midway in the tunnel was charged with concrete from the mixing plant through a 3x3-ft. inclined shaft, being chuted to a storage hopper at the top of the shaft and delivered to the gun through a 12-in. pipe. A 6-in. pipe ran from the

Two 20-ft. sections of 12-ft. traveling forms were gun to the forms.
assembled to constitute a pour for one shift. The lining was constructed from the entrance at the top of the diversion tunnel to the concrete gun, and then the forms were moved to the lower end and worked to the closing section, which was poured by gravity from the inclined shaft. A 3 per cent addition of diatomaecous earth was used in the concrete. This tunnel was grouted the full length, through 111 holes drilled to an average depth

of 10 ft. and about 16 ft. apart. The total amount of grout placed was 60 cu.yd., equivalent to 0.059 cu.ft. of grout per square foot of rock. The grout holes were drilled radially after the lining was completed.

Each hole was first tested with water and then a batch of rather thin neat cement grout was tried. If this was taken freely, fine sand was added up to a 1:1 mix, the consistency being judged by the amount of grout already placed in the hole. These grouting operations were apparently successful, as all seepage water into the tunnel was eliminated and no subsequent seepage from the power tunnel has been detected. The 12-ft. steel penstock leading to the turbines was started 33.5 ft. inside the concrete-lined tunnel, for anchorage and prevention of leakage.

Power Plant—A concrete power house provides for two 3,400-hp. turbines direct connected to 3,000-kva. generators. These turbines were designed for an average head of 65 ft. and a speed of 240 r.p.m. Current is generated at 2,300 volts and stepped up to 33,000 volts for long-distance transmission.

A surge tank, to prevent pressure rise in the long penstock, is 85 ft. high and 22 ft. in diameter, built of riveted steel plates $\frac{9}{16}$ to $\frac{1}{4}$ in. thick. It is located over the penstock Y, which branches from a 12-ft. diameter to two $8\frac{1}{2}$-ft. legs. For erection, a bulkhead closed the $7\frac{1}{2}$-ft. riser hole in the bottom, and a working platform was floated up as the work progressed. This platform was the full size of the tank, providing ample space for the rivet heater and workmen. This method provided a water test on the rivets. As fast as one course was completed, the water in the tank was raised; if leaky rivets were found the water was lowered and the rivets were replaced.

Engineers and Contractors—The Utah Construction Company, Salt Lake City, had the contracts for the dam, power house and installation of power units. Construction was started in May, 1925, and completed in July, 1927, six months ahead of contract time. The bid price was $1,288,121, and the total cost, including all materials, was about $1,800,000. Power development will add about $475,000, making a grand total of $2,275,000. This dam was built under the general direction of R. F. Walter, chief engineer of the U. S. Bureau of Reclamation, and the design was under the supervision of J. L. Savage, chief designing engineer. F. T. Crowe was field superintendent for the Utah Construction Company. The writer was engineer in charge for the Bureau of Reclamation. All work of this bureau is under the direction of Dr. Elwood Mead, commissioner of the Bureau of Reclamation.

Potential Water-Power Resources of Oregon

The potential water-power resources of Oregon amount to 3,665,000 hp., as estimated from the stream flow available 90 per cent of the time, or 5,890,000 hp. as estimated from the flow for 50 per cent of the time, if storage is provided in feasible reservoir sites, according to a statement by the Department of the Interior based on field work and studies of the Geological Survey. River surveys have been made and maps published by the survey covering 1,674 miles of rivers in the state. The river survey included a number of reservoir sites, and in addition 47 dam sites were surveyed on a large scale.

In its work of classifying the public lands the Geological Survey is collecting detailed information concerning the power-site value of every tract of public land.

Oiled Macadam Road Construction of Soft Stone

A Combination of Water-bound and Penetration Macadam for Roads of Intermediate Type

By B. E. Gray
Division Engineer, West Virginia State Road Commission, Keyser, W. Va.

Extract from a paper before the Highway Research Board, Washington, D. C., Dec. 2, 1927.

A MODIFIED bituminous macadam, "puddle macadam," has been used in the last three years in the construction of many miles of state highway in West Virginia. It permits the use of soft stone and of the crusher run. It allows traffic to use the road except for delays not exceeding fifteen minutes at a time during construction. It has the smoothness and traffic capacity of penetration macadam and is kept up by the same simple methods. Construction methods, the structure obtained and the cost of construction and maintenance are summarized here.

Method of Construction—The subgrade is prepared, rolled and checked with a template to within $\frac{1}{4}$ in. The base course may be of either crushed or knapped stone; where soft sandstone is used, the knapped base is preferable. This base

KNAPPING BASE-COURSE STONE

course is also checked by template to within $\frac{1}{4}$ in., and the top-course loose stone is spread with a spreader and templated off smooth and even to a depth of approximately 4 in. The top stone is then rolled and shaped, rolling from the edge to the center until a smooth and even surface is obtained. The first rolling should be about five or six times over the surface, just enough to shape and compact the loose stone and not enough to crush or break the stone particles. Some screenings and dust are then thrown on the surface so as to have about $\frac{1}{4}$ in. over the top of the stone; this is rolled and further dust is added until no movement is discernible under the roller. It is necessary to have this extra thickness of dust and screenings as with a lesser amount the fine particles will go to the bottom and the coarser particles will ride to the surface.

As soon as the surface has become smooth and without movement the surplus dust and screenings are swept to the side of the road, exposing the top particles of stone so that they present a mosaic appearance. Cold tar is then applied at the rate of 1 gal. per square yard. This is done either with a distributor or by hand. The latest practice is to

APPLYING COLD TAR SEAL COAT

OIL BOUND ROAD, SHENANDOAH MOUNTAINS

prepare a section of such length as will take one distributor load, going down one side and coming back the other. Traffic uses the road all the time except for the few minutes when the bituminous material is being poured and the cover coat is being applied. This cover coat consists of $\frac{1}{2}$ x $1\frac{1}{4}$-in. chips and when of soft sandstone usually crushes in two under the roller. Traffic immediately uses the surface and any uneven places are later brought to template and profile by the addition of chips and tar.

Traffic uses the road during the following winter, and the seal coat is not applied until May of the following year. The seal coat consists of $\frac{1}{4}$ to $\frac{3}{8}$ gal. per square yard, usually either hot asphalt, with $\frac{3}{4}$ x $1\frac{1}{2}$-i:. chips; cold asphalt, using $\frac{5}{8}$-in. chips, or cold tar, with $\frac{5}{8}$-in. chips.

Structure Secured—Hot asphalt is used on heavy grades and where it is desired to obtain a non-skid surface. The cost of construction varies according to the location, but in general is about 20 per cent less than penetration macadam. However, penetration macadam built with the same thickness of loose stone will have a final compacted thickness of about 3 in., whereas the final compacted thickness of the

SPREADING TOP COURSE STONE

puddle macadam is about 4 in. Sections of the surface dug up after twelve months' service show that the initial gallon of bituminous material penetrated practically to the bottom of the course and has produced a sort of bituminous concrete, in which the dust and screenings became impregnated with the bitumen and act as a matrix surrounding and holding the coarser stone particles in place. This type of construction will carry any traffic that can be carried by penetration, and the methods and cost of maintenance after the first seal coat are similar. Traffic on different roads constructed in northeastern West Virginia during the past three years varies from 500 to 3,000 vehicles per day, with an average daily traffic from 500 to 800.

First and Maintenance Costs—The accompanying table shows the construction and upkeep costs and the traffic on a number of widely separated roads. The cost figures per mile are:

Average depth base compacted 5 in.	$7,000
Top course compacted $3\frac{1}{2}$ in.	7,500
Bituminous binder, 10,000 gal.	2,000
Seal coat second year, 2,500 gal. plus cover	500
Average, 8 in. gravel base	6,000

All these figures are based on 18 ft. width. It requires nearly two tons of stone to make a cubic yard of compacted base or top. The table herewith, made up from a number of widely separated jobs, shows variations due to location and season. The maintenance cost is based on $\frac{1}{4}$-gal. surface treatment every three years, which under a steadily increasing traffic has so far been adequate.

Rhodesian Zambesi River Surveyed From the Air

Survey of the upper reaches of the Zambesi River in Northern Rhodesia in Africa has been begun by seaplanes operating from the river. Photographs of the territory are being taken from the planes. They will be scaled to control points fixed on the river bank by the astronomical ground party. Wireless receiving apparatus carried by the ground party is to fix accurate longitude by tuning in on European time signals of the true Greenwich mean time. The survey is expected to be completed by the end of the year.

Extension of Water Mains Financed by Tax

An annual tax of five cents per front foot on all property abutting streets or avenues having water mains is levied by the city of Yonkers to cover the cost of making extensions to its water distribution system. The city pays for the cost of making all extensions throughout a fiscal year and at the end of each year sells bonds to cover the amount of money advanced for extending the system. The frontage tax is used to provide interest and sinking funds on the outstanding bonds. A petition to the city council, containing the signatures of a majority of the abutting property owners, is required to start proceedings for extending mains.

New Office Building Houses Engineers

Western Society of Engineers to Occupy 23d Floor of Chicago Office Building—Assembly Hall on Second Floor—Girder Framing—Special Ventilation

DEVOTING office buildings to the use of occupants in specific lines of business or industry is becoming usual practice, as instanced in various buildings under the names of lumber, railway, insurance, builders, jewelers and other exchanges. But the new

FIG. 1—THE ENGINEERING BUILDING, CHICAGO
At its right is the Evening Post Building, using the same foundation piers on the property line. The street level is the upper deck of Wacker Drive, and the Wells St. bridge carries an elevated railway on its upper deck.

Engineering Building at Chicago is of special note in that it not only provides ordinary office accommodations for the grouping of engineers and engineering firms but also houses the headquarters, library, assembly rooms and other facilities of the Western Society of Engineers, the space being secured under a lease from the owners of the building. A general view of the building under construction is given in Fig. 1, with a typical cross-section in Fig. 2.

This building, at the corner of Wells St. and Wacker Drive, is a 23-story steel-frame structure about 101x150 ft., with its narrower ends fronting on the drive and on an alley known as Haddock Place. As Wacker Drive is a double-deck thoroughfare, the main or first floor of the building is at the elevation of the upper deck, 19 ft. 9 in. above datum, which is the water level of the Chicago River. The basement, at El. 6 ft. 9 in., is level with the lower deck, or freight-traffic, street and will be utilized mainly as a garage, giving accommodation for about 50 cars. Below this are the sub-basement and the boiler room, at 4 ft. 8 in. and 12 ft. 9 in. below datum.

Concrete foundation piers built in open caissons are carried down to hardpan at an average depth of 67 ft. below datum. Near the bottom each pier is increased in diameter for a depth of 8 to 12 ft., and is then belled out at an angle of 60 deg. from the horizontal to give ample bearing area, limiting the load on hardpan to 11,500 lb. per sq.ft. For the bell and enlargement the concrete is a 1:2:4 mix, whereas for the main shaft of the pier it is 1:1:2. The reason for not carrying the piers down to rock was that between the 16-ft. stratum of good hardpan and the solid rock there is a layer of quicksand about 25 ft. thick, and it was feared that disturbance of this quicksand might affect neighboring buildings the foundations of which are not carried to rock.

Joint use of foundation piers by two adjacent buildings has eliminated the use of cantilever girders in the foundations, such as are required in many cases to carry wall columns where the foundation piers must be kept within the property line. Each of these inner piers has its center on the property line and is designed to carry two columns, for the walls of the Engineering Building and the adjacent Chicago Evening Post Building.

The offices, library, committee rooms and other facilities of the Western Society of Engineers will be on the 23d floor, and its large assembly room will be on the second floor, with ample stairway accommodation, as shown in Fig. 3. This room, 46x83 ft., is surrounded by a wide corridor on all sides and has doorways in two sides. Outside of the corridor are offices on the two street fronts of the building; the elevators occupy

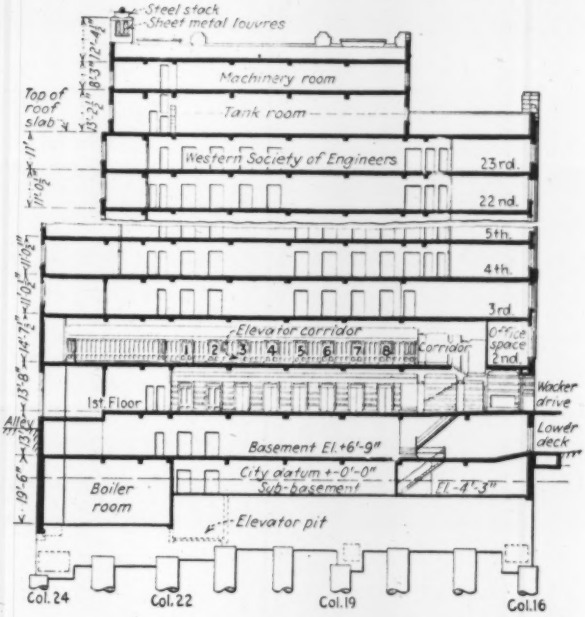


FIG. 2—CROSS-SECTION OF ENGINEERING BUILDING

a third side. On the fourth side are toilet and rest rooms and other service accommodations auxiliary to the assembly hall.

Floor System—The second-floor location of the assembly hall was adopted for reasons of general con-

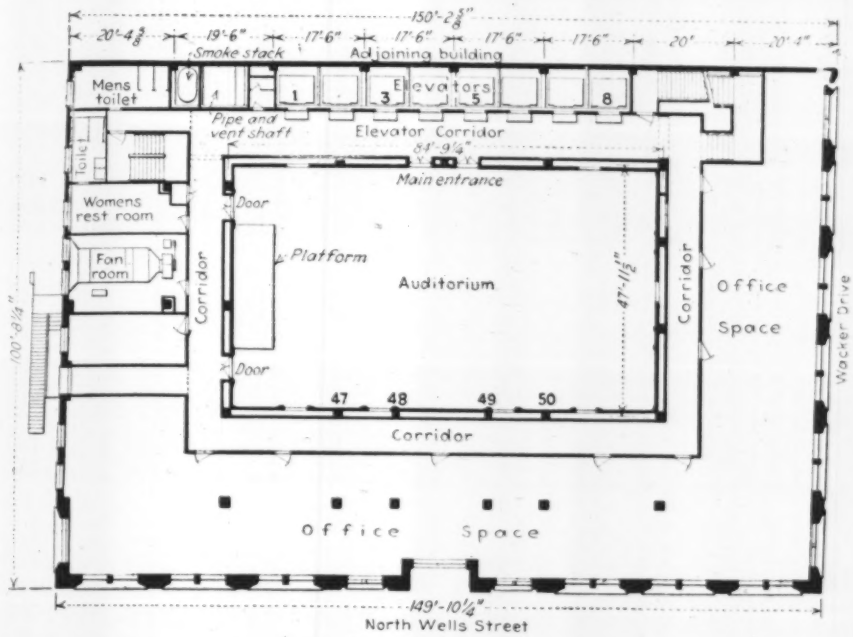


FIG. 3—PLAN AT ASSEMBLY ROOM (SECOND FLOOR)

venience, as large gatherings can assemble and disperse without requiring elevator service. At the same time the arrangement involves special framing at the fourth floor, or roof level of assembly hall, with long girders supporting columns for the upper floors, as shown by Fig. 5. The structural roof is at the fourth floor, but an ornamental ceiling midway between the third and fourth floors provides an overhead space for ventilating conduits and other facilities. On the east, or Wells St., front there is a recessed court above the fourth floor level, in the space between columns 4, 54, 51 and 7. From the framing plan, Fig. 5, it will be seen that columns 51, 52-A and 54 begin at the fourth floor, whereas columns 5, 31, 48, 49, 32 and 6 extend to only the fourth floor.

Except for the fourth floor girders over the assembly room and some smaller girders for column offsets in the upper stories, the framing is of steel beams throughout. An interesting structural feature is that all the columns are rolled H-beams, with the exception that the columns supporting the long girders and thus having heavy loads are H-sections built up of plates and angles. The typical floor framing, including spandrels, consists of I-beams and H-beams, forming panels which range from 11 ft. 3 in. x 5 ft. 2 in. to 16 ft. 9 in. x 31 ft. 8 in.

Concrete floors are all of the slab and joist type, with the joist spacing uniform throughout, so that in case of future necessity for cutting holes for plumbing or pipes the joists can be easily located and avoided. Live loads are 100 lb. per sq.ft. for the first and second floors, including the assembly hall, and 50 lb. for the other floors, this latter not including the partitions. Tile flooring will be used in the corridors, but the offices and assembly room will have flooring of maple or oak.

Girder Framing — Three double-plate girders 48 ft. long span the assembly room and carry three lines of interior columns (51, 52-A and 54) for the upper stories. Two of the girders are framed between supporting columns, while the middle girder is framed against a reaction girder 18 ft. long, the ends of which rest directly upon columns 48 and 49, which do not extend above the fourth floor. These girders are shown in Fig. 4. Each of the double long or twin girders, 48 ft. c. to c. of columns, consists of two independent plate girders 6 ft. deep and spaced 18 in. c. to c. of webs. These girders are not connected by diaphragms or cover plates, each girder having its own flange angles and cover plates. In two of the double girders the 72-in. web is 1 in. thick, with flange angles 8x8x1⅛ in. and side reinforcing plates 14x1 in. and 7x1⅛ in. The deeper plate is outside the angle and the narrower one is a filler between that plate and the web.

In the third double girder somewhat lighter construction is used, as it comes in the wall of a court. Each of the 72-in. web plates is ⅞ in. thick and there are no side reinforcing plates at the flange angles. In all these girders the webs are heavily reinforced at mid-span by stiffeners and filler plates grouped under the cast-steel slab forming the base of the supported column. The fourth, or reaction, girder, 18 ft. long, is of single web

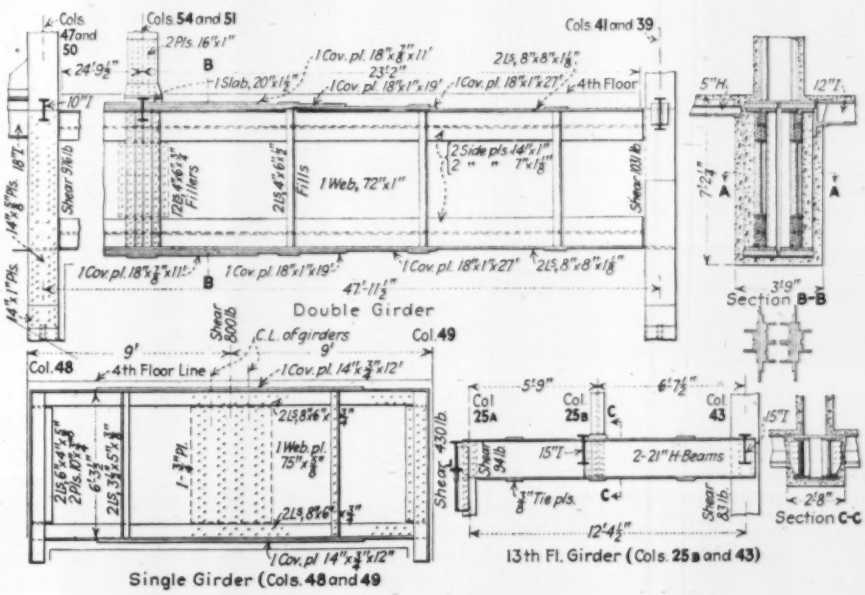


FIG. 4—DETAILS OF GIRDERS

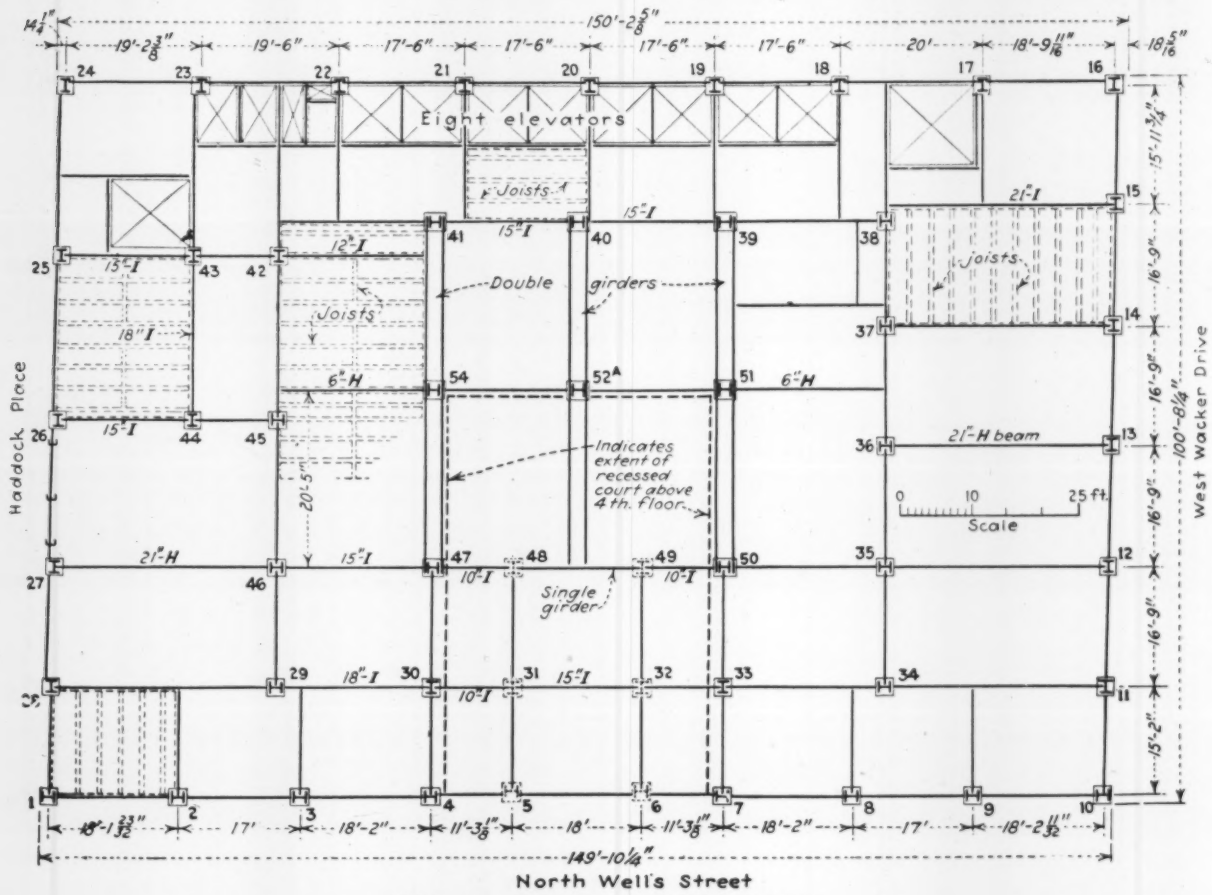


FIG. 5—FRAMING PLAN AT FOURTH FLOOR
Girders carry columns over assembly room

construction, with its 75x⅝-in. web plate reinforced at mid-span by a ¾-in. plate for the attachment of the middle 48-ft. girder. For fire protection the girders are cased in concrete, secured by wire mesh wrapped around the flanges, but the concrete is not filled in between the webs.

Smaller girders are required in a few places in the upper floors, mainly where columns in the wall on the alley side have to be set back to meet the requirements of the building ordinance. Some of these girders are single 30-in. H-beams of 19 ft. 2 in. span; others are pairs of 21-in. H-beams. The offsets occur at the eighth, thirteenth and eighteenth floors. A typical construction is shown in Fig. 4. Spandrel beams in the main and court walls form wind girders and consist of H-beams connected to the columns by knee braces. As a rule these braces are on top of the spandrel beams, but in certain cases they are placed below the beams for convenience of design Typical arrangements are shown in Fig. 6. For typical connections of floor beams to interior columns, also shown in Fig. 6, the beams have vertical connection angles riveted to the webs; the top and bottom flanges are riveted to horizontal angle brackets or lugs on the columns.

Elevators and Ventilation—Eight elevators are arranged in a row against the west wall. This arrangement is due to the fact that with an adjacent building on this side it is not practicable to provide windows, hence the space is not suitable for office purposes. The smokestack, ventilating stack, pipe shafts and stairway shafts are also located along this side of the building.

Although artificial ventilation is not required in ordinary office buildings, it was necessary to provide special ventilating facilities for the assembly hall. For this purpose warmed or cooled fresh air is blown in through ducts leading to grills in the walls at a height of 12 ft. from the floor. Exhaust ducts connect with similar

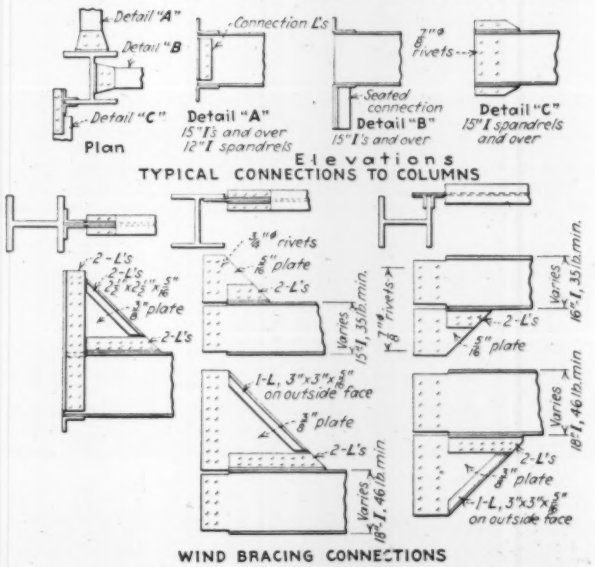


FIG. 6—WIND BRACING AND INTERIOR CONNECTIONS

grills in the ceiling and in the walls just above the floor level. These ducts, arranged between the ceiling and the fourth floor, as shown in Fig. 7, are served by motor-driven fans placed on the second and third floors. The fresh air fans are connected to air-washer apparatus, and the exhaust fans deliver the foul air to a ventilating stack that extends to the roof. Special ventilation was also needed for the basement garage, but here only exhaust fans and ducts are used, discharging into the same stack.

Steel erection was done rapidly with the use of two steel guyed derricks, one of 25 tons and the other of 10

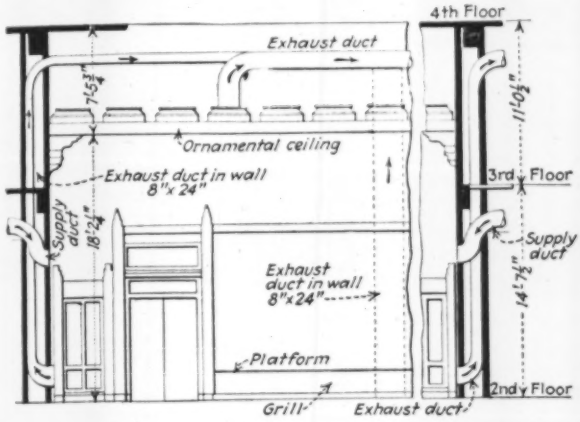


FIG. 7—VENTILATION OF ASSEMBLY ROOM

tons hoisting capacity. This part of the work was begun on Sept. 15 and completed on Nov. 1, placing 3,023 tons of steel in 40 working days.

D. H. Burnham & Company, Inc., is the architect, and F. D. Chase, Inc., the engineer. Paschen Brothers were the general contractors. The structural steel was fabricated by the American Bridge Company and erected by the Overland Construction Company.

Salton Sea Needs More Area for Evaporation

Surveys of the Salton Sea in Imperial Valley in California and a study of the local water problems there recently completed by George F. Holbrook, an assistant engineer of the Geological Survey, have led to the conclusion that "in order to evaporate the amount of water that may be wasted into Salton Sea under conditions of ultimate irrigation and development, an average water surface area of 239,000 acres will be necessary. This corresponds to a lake surface 228 ft. below sea level or some 20 ft. higher than the present lake surface." The report is not to be published but may be examined at the offices of the Geological Survey in Washington, D. C., and in San Francisco.

Use of Water Power Increases

During the quarter ended Dec. 31, 1927, applications for permits or licenses under the federal water-power act to the Federal Power Commission increased from 839 to 864. These 25 additional applications involved 234,000 primary horsepower and an estimated installation of 610,190 hp. The aggregate capacity of projects covered by applications pending and already granted on Dec. 31 was approximately 11,680,000 primary hp. and 25,822,000 hp. proposed installation.

Detroit Extends Paved Streets 554 Miles in Five Years

DETROIT has built 554 miles of new street paving and 223 miles of alley paving in the five-year period 1923-1927, at a total cost of $50,479,540, exclusive of maintenance and repaving. These figures are an indication of the activity in street extension required to keep pace with the growth of the city. The annual figures of length and cost for this period are given in the accompanying table, prepared by Perry A. Fellows, city engineer. They include excavation, curbing and paving, but not drainage.

All this work was done under contracts awarded to the lowest bidders, with nine contractors active in street work and ten in alley work during 1927. The average annual extension of street paving during this five-year period was about 111 miles, while for the ten years 1913-1923 the average was about 42 miles, with a total of 418 miles. Previously to 1913 the average was only 15 miles per year.

Standard sheet-asphalt pavement consists of an 8-in. 1:2½:4½ concrete base with 1½-in. binder and 2-in. top course. The standard one-course concrete pavement for streets is 8 in. thick, with a 1:2:3 mix. The standard alley pavement is a dished slab of 1:2:3 concrete, 5 in. thick at the sides and 7 in. at the center. Both stone and concrete curbs are used on streets. The minimum width of street pavements is 30 ft.; alley pavements average 18 and 20 ft. in width. The specifications require precast

NEW PAVING AT DETROIT IN 1923–1927*

Year	Number	Miles	Area, Sq.Yd.	Cost	Average Cost Per Sq.Yd.
Streets					
1923	154	46.82	809,278	$4,625,220	$5.99
1924	202	72.05	1,367,155	6,609,423	4.73
1925	368	118.00	2,373,074	10,278,399	4.24
1926	505	148.60	2,928,414	11,575,414	3.86
1927	528	168.44	3,338,509	11,870,163	3.55
Total	1,757	554.00	11,086,430	$44,958,619	$4.05
1928 (est.)	.....	180.00	3,532,419	.....	.....
Alleys					
1923	185	22.64	240,426	670,154	2.74
1924	257	36.71	390,010	1,025,170	2.58
1925	348	44.64	469,570	1,160,020	2.40
1926	448	57.40	599,309	1,346,815	2.20
1927	525	62.31	646,768	1,318,762	2.04
Total	1,763	223.00	2,346,083	$5,520,921	$2.35
1928 (est.)	.....	73.00	758,501	.....	.....
Total streets and alleys (1923–1927)				$50,479,540	.....

* In this table, the miles, square yards and total cost of paving are for contracts completed, and the figures of average cost are for contracts awarded. It is much easier to ascertain this average cost than that of contracts completed as the work progresses, and the record charts and tables are all made on this basis. The average cost as computed from the figures of yardage and total cost in the table will vary from that for contracts awarded, due in part to the fact that many 1923 contracts were held over from 1922 on a rising market, whereas after 1923 many contracts completed had been held over from the preceding year on a falling market. However, the general trend of conditions is shown equally well by the averages computed in either way.

test cylinders of concrete to show a minimum strength of 2,500 lb. in compression at 28 days, and no pavement is accepted until cores drilled at 28 days and tested indicate that both quality and thickness are satisfactory. During 1927, however, the average compressive strength of all cores actually tested was more than 3,500 lb.

This extensive paving program is a result of the annexation in 1924 and 1925 of 46 square miles of new territory, making a total area for the city today of 139 square miles. Included in the annexed district were 990 miles of unpaved streets, many miles of which were being built up and awaiting city facilities. At present Detroit has 2,670 miles of streets, of which 1,380 miles are paved; and 1,850 miles of alleys, 410 miles paved.

How to Prevent Termite Damage to Buildings

Remedy Is Not in the Type or Kind of Construction Material, but in the Manner in Which It Is Utilized Thousands of Dollars May Be Saved by Proper Methods of Construction

By Thomas E. Snyder
Entomologist, Bureau of Entomology, U. S. Department of Agriculture

TERMITES, or "white ants," are by no means restricted to tropical countries; they occur in the United States, and their damage to the woodwork of buildings is especially serious in the southeastern, central western, southwestern and Pacific Coast states. Much more serious termite injury occurs in the tropical possessions of the United States, where different and more destructive termites are to be found.

Description of Termites—Termites are not true ants, although they are antlike and live in large colonies made up of different forms. In these nests or colonies, in earth or wood, both wingless and winged mature individuals are produced. The brownish or blackish elongate, slender, sexual adults (Fig. 1), with long white wings, unlike the other forms have functional eyes and are able to endure full sunlight. These migratory males and females appear normally only once a year during a short period to form new colonies and are often mistaken for flying ants.

The grayish white, soft-bodied, wingless "workers" (Fig. 2) are in reality the destructive form. These workers make the excavations and enlarge and extend the colony as this becomes necessary. They live underground, shun the light and are therefore rarely seen. They do not crawl about in the open as do ants, but always remain in earthlike shelter tubes when they leave the earth or wood in order to reach woodwork above the ground (Fig. 3). Their damage is hidden within the

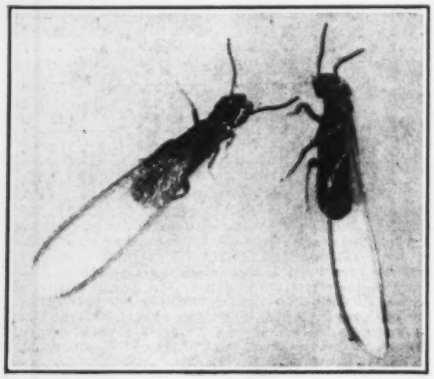


FIG. 1—FLYING TERMITES
The appearance of these in a building should be a warning that the woodwork is being damaged. These insects are less than ½-in. long.

wood, and the interior of the wood may be entirely eaten out, since they leave intact a protective outer shell, so that the damage is often unsuspected until beyond repair. (Fig. 4.)

Habits of Termites—Termites which most seriously damage buildings and structurally weaken supporting timbers are those that live in the ground and attack wood only indirectly from the ground. These ground-nesting termites require much moisture for their life. They obtain it from the earth, with which they must always maintain contact. When once they have been shut off from their supply of moisture in the earth, they will dry up and die, and timbers which they have damaged need not be replaced unless they have been structurally weakened or are unsightly.

Most termite damage to buildings is directly due to improper methods of construction. With the clearing of the forests—the natural home of termites—and advancing civilization, cultivation of lands, the destruction of their breeding places and more extensive building operations by man, termite injury has become more common and serious.

It is not the type or kind of construction material but the manner in which it is utilized that will prevent termite damage. Wood, masonry, concrete, brick, hollow tile, stucco and even rammed earth can all be effectively

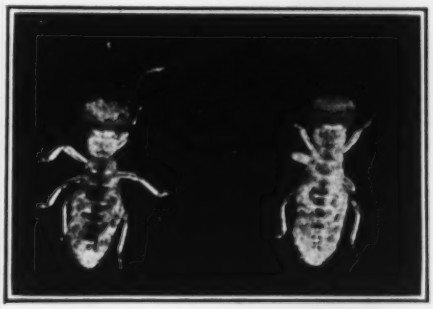


FIG. 2—WOOD-BORING TERMITES
The destructive form or worker of the ground-nesting termite. Workers are ¼-in. in length.

used so that buildings will not be attacked by termites. Timber or lumber can be utilized safely by proper construction or by impregnation with chemical preservatives, as recommended for foundations.

A few hundred dollars additional (2 per cent of the first cost) spent in the proper construction of buildings may save thousands of dollars in later repairs and replacements due to termite damage. Prevention is much simpler and cheaper than any remedial measures, since after termites are once established in a building they may be very difficult to eradicate; furthermore, these repairs may be a serious financial strain to the small housebuilder. As the most practicable method of preventing destruction by termites, slight modification of city building codes has been recommended for some time by the Bureau of Entomology to include a few simple suggestions for excluding them.

In rural regions, county agricultural agents are available for assistance and advice to prospective housebuilders and owners on the proper methods of construction so necessary to prevent termite damage.

Provisions for Preventing Termite Damage—Wood or fiber products, when not impregnated with an approved preservative, shall not be placed in contact with the earth or within 18 in. thereof, excepting wood columns or posts over a concrete floor, which shall be provided with non-corroding metal or concrete base plates or footings 6 in. above the floor. This also applies to steps, where the concrete base should extend beyond the steps for at least 6 in.

Timber to be used in contact with the earth shall be thoroughly impregnated by a standard pressure process with coal-tar creosote or other equivalent preservative. Timber should be completely framed before treatment, whenever possible, but when cutting after treatment is unavoidable, the cut surface shall be thoroughly coated with coal-tar creosote or other equivalent preservative.

Masonry foundations and footings shall be laid in portland cement mortar. Foundations built up of masonry units, whether hollow or solid, shall be capped below woodwork with at least 1 in. of portland cement mortar, or cement and slate, or solid or joined non-corroding metal, or other equally efficient seal.

A metal termite shield or mechanical barrier shall be provided, continuing completely around the surface of the

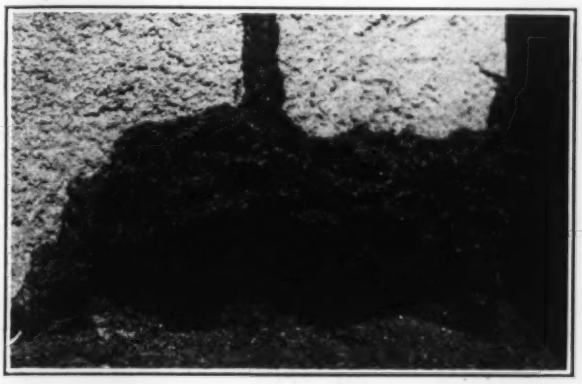


FIG. 3—SHELTER TUBES OF GROUND-NESTING TERMITES

These are constructed of earth mixed with finely digested, excreted wood, and are built over a concrete wall. These tubes extend through cracks between the basement flooring and the walls. Note the granular structure. The insects use these tubes in passing over impenetrable substances and to protect them from the light in extending their galleries, in this case up to the next floor in a building in Washington, D. C.

foundation, including all pillars, supports and piping, below the woodwork of the building, on both the inside and outside surfaces. Such a shield shuts off the shelter tubes of termites and may be formed of a strip of non-corroding metal (such as copper, zinc or Monel) firmly inserted in the surface of the masonry or between the foundation and the wood, with the projecting edge bent downward at an angle of 45 deg. and extending horizontally at least 2 in. from the face of the foundation (Fig. 5). These shields may be made decorative and need not be unsightly.

Floor sleepers or joists embedded in masonry or concrete, or laid on concrete which is in contact with the earth, shall be impregnated with an approved preservative.

Expansion joints between concrete floor and wall shall be filled with liquid asphaltum and the right-angle joint covered with a sanitary cement mortar or portland cement concrete finish of an arc of at least 2 in. maximum diameter.

The ends of beams or girders entering masonry or concrete shall not be sealed in, but shall be provided with boxes affording an air space at the end of the piece of not less than 1 in. at side of member, unless the ends of such timbers are impregnated with coal-tar creosote or other approved preservative.

Where there are spaces under floors near the earth, they shall be excavated so that there will be no earth within 18 in. of the wood, and they shall be provided with cross-ventilation. Such ventilating openings shall be proportioned on the basis of 2 sq.ft. for each 25 lin.ft. of exterior wall, except that such openings need not be placed in front of such building. Each opening shall be provided with 20-mesh non-corroding metal screening.

Where timber is used in roofs of the flat type, the roof shall, unless protected on the weather side with a covering impervious to water, have a slope and run-off sufficient to provide proper drainage.

All wooden forms shall be removed from masonry work within fifteen days.

Location of Damage—The approximate point of entrance should be sought at once by careful examination of all woodwork in contact with or near the ground.

The annual emergence of large numbers of the flying white ants is a warning that the woodwork is infested, and the point of emergence indicates the approximate location of the infested timbers. Often large numbers of dead winged forms or the discarded wings will be found near by, even if the flying ants are not seen coming from the wood.

When efforts are made to stop further damage by termites in buildings, it should be realized that their numbers may be constantly recruited from some undiscovered, outside, central colony. The destruction of the winged colonizing adults at the time of emergence, although beneficial in preventing the establishment of potential new colonies, will not eradicate the insects infesting the woodwork.

Another warning of the presence of termite infestation is branching shelter tubes of small diameter, constructed of earth mixed with finely digested wood, on foundation timbers or other woodwork, or over the surface of stone, brick or other impenetrable foundation material from the ground to the woodwork.

Remedies the Same as Methods of Prevention

The preventive provisions apply to buildings already constructed as well as to new buildings. By following these suggestions termites can be eradicated from buildings already infested.

Disconnecting Wood From the Ground—Ground-nesting termites infesting beams or other wood will die out if the wood is disconnected from the ground; this

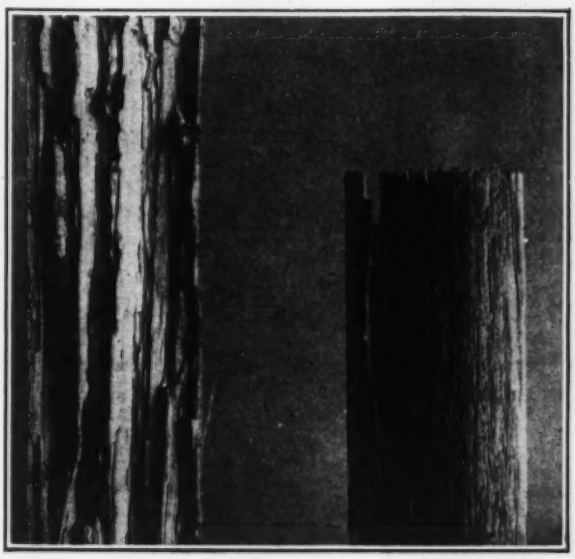


FIG. 4—FLOORING DAMAGED BY GROUND-NESTING TERMITE

Note how the interior is eaten out, but the surface shows no signs of injury.

will save time and expense, especially in the case of old frame buildings, where extensive repairs would be unwarranted. Disconnecting untreated foundation timbers from contact with the soil will also cause the death of these termites in the other woodwork furniture and stored material in the building, even if they have penetrated to the second or third floors. These timbers need not be removed or replaced unless seriously weak-

ened structurally. However, if the wood is kept moist by some other means, such as water leakage, the termites will continue to work and thrive. This applies especially to damp corners of basements near outside water pipes, bathrooms, kitchens and the like.

Wooden floors laid directly on the ground or on tar or tar paper, or on stringers on the ground, or set in concrete, should be removed. There should be a layer of concrete between the earth and the wood.

Capping—Foundations built up of masonry units, whether hollow or solid, should be capped below woodwork with at least 1 in. portland cement mortar, or cement and slate, or solid or joined non-corroding metal, or other equally efficient seal. Often an infested frame building need not be raised or jacked up to cap the wall, but the upper tier of bricks can be removed, a few at a time, and the capping accomplished.

Where poor grades of mortar have been used in masonry walls below the ground, it may be necessary to surface the outside or inside of the wall with portland cement or concrete to prevent penetration by termites.

Metal Shields—A metal termite shield should be put in place, continuing completely around the surface of the foundation, including all pillars, supports and piping, below the woodwork of the building, on both the inside and outside surfaces to shut off the earthlike shelter tubes of termites.

SUMMARY

The principles of prevention and remedial measures are: (1) Isolation or insulation of all untreated woodwork from contact with the ground, either by the use of stone or concrete foundations, care being taken to utilize only the most impenetrable grades of mortar and plaster, or by the use of timber impregnated with coal-tar creosote; (2) use of metal termite guards or shields over foundations to prevent the ground-nesting termites from extending their earthlike shelter tubes up over the surface of impenetrable foundations to untreated wood above. These shields of sheet copper, zinc or Monel are inserted over the masory extending outward horizontally for 2 in., and the projecting edges are turned down at an angle of 45 deg.

For a more complete description of termites and their habits see Farmers' Bulletin 1472, U. S. Department of Agriculture.

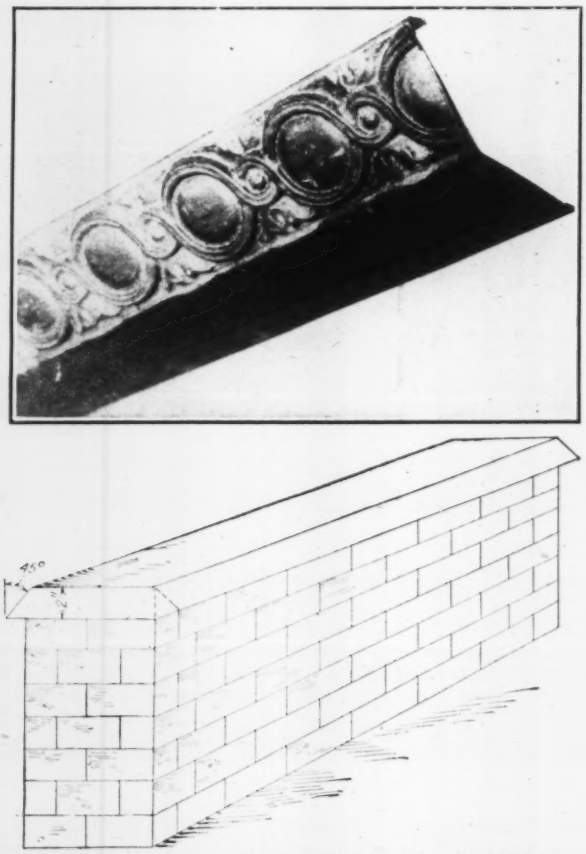


FIG. 5—DEVICE TO PREVENT TERMITE RAVAGES
Above, metal shield to act as a mechanical barrier to termite shelter tubes. Below, shield in place on top of a brick wall.

Indiana Municipal Budget Law

THE Indiana budget law, passed in 1927, requires that each taxing unit of any municipal corporation must prepare a budget on forms provided by the state Board of Accounts. The budget must set forth the detail of the proposed expenditure, a statement of the taxable property in the district affected and the tax rate necessary to produce the amount required. It must be advertised in at least one newspaper and a public hearing must be held not sooner than ten days after such advertisement.

This budget is certified to the state Board of Tax Commissioners by the county auditor, and it becomes, with its rate of taxation, binding for the unit for the following year, unless modified by the state Tax Board. It may be modified by that board only on appeal signed by any ten affected taxpayers, other than those who pay poll taxes only. Such an appeal must be filed with the board not later than the fourth Monday in September, whereupon the board "within a reasonable time" shall hold a public hearing in the county from which the appeal originates. Notice of the hearing must be given to the executive officer of the taxing unit and to the first ten remonstrators at least five days before it is to be held. After the public hearing the state Tax Board makes its ruling, establishing the tax rate and modifying the items in the proposed budget, if necessary, to meet the rate established. This rate and modification are certified to the county auditor and become binding and final.

In cases of "casualty, accident or great emergency" the taxing unit may appropriate money in excess of the budget, subject to the same procedure and limitations as apply to the original budget, except that instead of requiring that the hearing shall be called within " a reasonable time" it must be within not less than ten or more than fifteen days. A penalty equal to the unauthorized expenditure, plus 25 per cent and costs, including "reasonable" attorney's fees, is provided to apply to the unauthorized expenditure of money, to be paid by the local authorities responsible for the unauthorized expenditure.

The budget form provided by the state Board of Accounts is divided into eight major divisions: (1) services: personal, regular and temporary; (2) services: contractual, including communication, transportation, heat, power, water, instruction, printing and repairs; (3) supplies: material purchased which has a short life; (4) materials: material entering into permanent structures or use; (5) current charges: insurance, rents, etc.; (6) current obligations: interest and temporary loans; (7) properties: upkeep of permanent structures and equipment, including live stock (similar to No. 4); (8) debt payment bonds, etc.

Forecasting Mississippi Flood Stages

How the Weather Bureau Predicts Channel Stages and Depth of Overland Flooding—Rate of Travel of Overflow Waters—Special Work Required to Meet the Grave Emergency of Last May

By Dr. Isaac M. Cline
Senior Meteorologist, U. S. Weather Bureau, New Orleans

Flood Prediction for the Mississippi as carried on by the New Orleans office of the Weather Bureau for nearly a quarter century has been a remarkable aid to the flood fighters and a means of saving many lives. During last year's flood it was of critical value; the security of an extensive population depended on the accuracy of the predictions. The results achieved were possible only through resourceful use of the scanty topographical data available, in connection with prior observations on rate of overland travel of flood water, to predict time and depth of flooding. Neither this work nor the normal prediction of channel stages had been recorded until a few weeks ago, when Dr. Cline described it at a meeting of the American Meteorological Society at Nashville. The present article is a condensation of his statement.—Editor.

Some 200 years ago a levee about 3 ft. high was constructed in front of New Orleans. Since that time the fight against the water has been waged by man to keep back the flood, with only partial success. During the 100 years from 1728 to 1827 there is historical record of thirteen important floods. During the following century, 1828 to 1927, floods occurred frequently, but the uniformity of crests of floods until 1871 indicates that the alluvial bottoms were overflowed generally at a stage near or slightly above 15 ft. on the present Carrollton gage at New Orleans. Prior to 1874 the construction of embankments on the Mississippi River had not been carried to a point where they would have a tendency to cause an increase in flood heights.

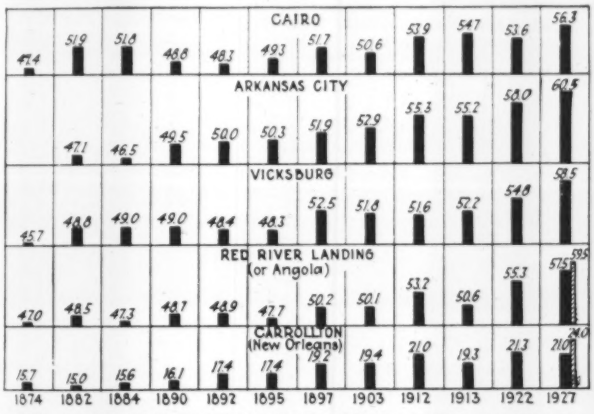


FIG. 1—CREST HEIGHTS OF GAGES HAVE BEEN MATERIALLY RAISED BEGINNING WITH 1897 FLOODS, WHEN LEVEES BEGAN TO HOLD

In 1874 Congress took action to protect the Mississippi bottoms from floods. An act creating the Mississippi River Commission followed a few years later, in 1879. It required a few more years after the organization of the commission and the commencement of work before the levees could be strengthened and raised sufficiently to increase flood heights materially. This is illustrated in Fig. 1, where it is shown that there was no increase in flood heights of note up to and including 1893.

After 1874 we have a new régime in flood history and flood crests, and crevasses from this time forward are important in the study of flood forecasting. Fig. 1 is a graphical record of the flood crests from 1874 to 1927.

Course of Overflow Water—Flood water, which passes out through crevasses in the right bank of the Mississippi River above the mouth of the Arkansas River, returns to the main stream through the St. Francis, White and Arkansas rivers except when crevasses in the right bank of the lower Arkansas allow it to pass through into the Tensas Basin. Water from crevasses in the right bank between the mouth of the Arkansas and Red River Landing returns to the Mississippi and the Atchafalaya through the Tensas Basin and Old River and shows up at Angola on the Mississippi and at Barbre Landing on the Atchafalaya. Flood water from crevasses in the left bank of the Mississippi above Vicksburg returns to the main stream through the Yazoo River. The left bank of the Mississippi River from Vicksburg to Baton Rouge is high and there are no important overflows in this stretch.

Flood water from crevasses in the Old River levees and along the Atchafalaya and on the right bank of the Mississippi River between Angola and Donaldsonville spreads over the Atchafalaya Basin and passes out at Morgan City to the Gulf. Flood water from crevasses in the left bank of the Mississippi below Baton Rouge and in the right bank below Donaldsonville does not return to the main stream, but finds an outlet direct to the Gulf.

Flood Forecasting Begun in 1903—The Weather Bureau has during the last quarter of a century made great advances in the study and improvement of flood forecasting. We find no warnings for crest stages in advance of the 1897 flood. The next great flood was in 1903, and the warnings issued by the Weather Bureau for the lower Mississippi for this flood are illustrated in the following forecast issued March 9, 1903:

> The Mississippi River is now within 1.4 ft. of the highest water ever recorded, and the Atchafalaya within 1 ft. of the highest water on record. These rivers will continue to rise slowly during the next three or four weeks, and all interests are advised to prepare for a stage of 21 ft. at New Orleans and a corresponding rise in the Atchafalaya, if levees hold the volume of water now coming.

To meet this stage it was necessary to raise the levees in many places 2 to 4 ft. within the time given; this was accomplished. On April 6 and 7 a stage of 20.7 ft. was reached at New Orleans, and had it not been for the Hymelia crevasse in the right bank of the river 40 miles above New Orleans, there would have been a further slight rise.

Similar forecasts with corresponding accuracy have been issued for all important floods in the lower Mississippi River during the last quarter of a century.

Gage Relationships—Below Angola (Red River Landing) there is less complication than above that place. In Fig. 2 are given the gage relationships based on Angola for floods up to and including 1927. This graph shows independently in broken lines the gage relationship for the early floods, in the years when the levees were low or incomplete, for Baton Rouge, Plaquemine and Carrollton. These are interesting, in that they show that in the

early years a stage of 49 ft. at Angola correspond to 36 ft. at Baton Rouge, 31.5 ft. at Plaquemine and 15 ft. at Carrollton. Since the extension and strengthening of the levees, 49 ft. at Angola corresponds to 38.8 ft. at Baton Rouge, 34.6 ft. at Plaquemine and 18.6 ft. at Carrollton. Thus there has been an increase of 3 to 3½ ft. at all three points below Angola as a result of increased levee protection. At Carrollton, with the low levees for nearly 50 years prior to 1874 the maximum stage was only slightly above 15 ft., whereas with the entire levee system intact the flood of 1927 would have given nearly 26 ft. on the Carrollton gage, a gain of 10 ft. as the result of levee construction in 53 years.

Any crevasse below Old River changes the gage relationship materially, depending on the location of the

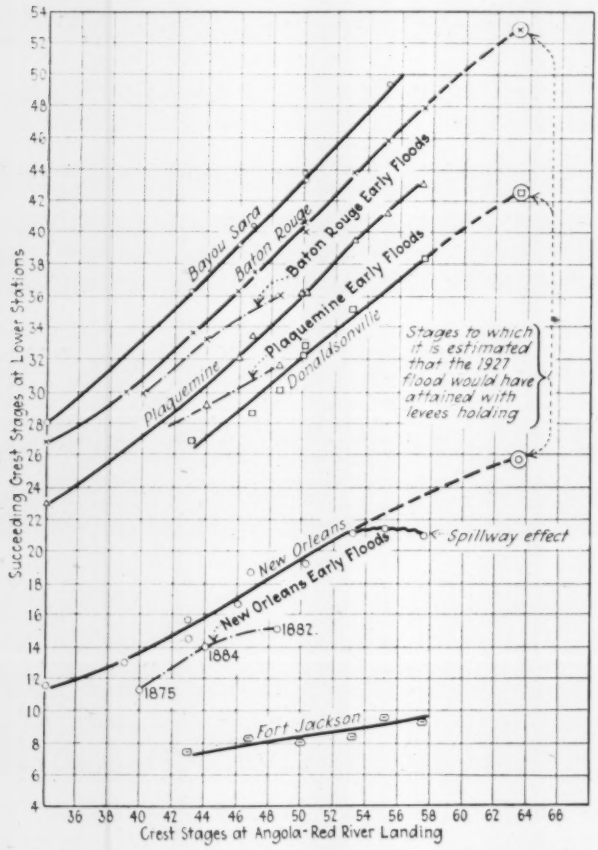


FIG. 2—GAGE RELATIONSHIPS BETWEEN CREST STAGES AT ANGOLA AND SUCCEEDING CRESTS AT LOWER STATIONS

crevasse as related to the gaging stations. The spillway effect is shown on the Carrollton gage at New Orleans in the curve at 21 ft. caused by the Poydras crevasse in 1922 and Caernarvon spillway in 1927. Changes of 1 ft. or more shown on the Carrollton gage are caused by wind, rising when fresh east to southeast winds prevail for a few days and falling when northwest to north winds prevail.

When there are no floods of importance in the Red and Ouachita rivers, the Atchafalaya carries a large quantity of the flood waters from the main channel of the Mississippi. Even with floods in the Red and Ouachita there is still some flow from the Mississippi main channel toward the Atchafalaya. This discharge occurs in all large floods except in the case of extensive crevasses in the right bank of the Mississippi above Old River, when the flow from the main channel toward the Atchafalaya is sometimes reversed. Gages on the leveed portion of the Atchafalaya correspond in the main to the stages at Angola, in the following relations in important floods: Simmesport 3 to 4 ft. and Melville 9 to 9.5 ft. below the Angola stage. The slope from Angola to Barbre Landing during floods is ordinarily about 0.5 ft. The extension of levees on the Atchafalaya has caused a piling up of the water, giving increased stages at Simmesport, Melville and other points within the levees over stages in former years.

A Forecast Saves Lives—On May 1, 1927, based on conditions developing at that time, the flood forecast for the Bayou des Glaises and Old River section was raised 1.5 ft. and to 4.2 ft. above the previous highest flood crest of record. This forecast placed the water level considerably higher than the levees along Old River and Bayou des Glaises. The warning was immediately given to every telephone operator in the rich and populous territory immediately protected by the Bayou des Glaises levee, and ex-Gov. John M. Parker, national and state flood co-ordinator, called every town in the area by telephone and advised those in authority to have the people move out immediately. The warning had the desired effect. Two weeks later, when the levees gave way and a wall of water 8 to 14 ft. high swept the residences in that region from their foundation, the several thousand persons had been moved out of the danger zone and not one was drowned, although it was the greatest onrush of water of record in the Mississippi Valley.

Forecasting Overland Floods—During the early settlement and development of this section overland floods occurred in the lower Mississippi Valley nearly every year. With the extension and strengthening of the levees the population residing in the low lands increased rapidly, the agricultural and commercial interests developed to vast proportions, the number and frequency of crevasses decreased and flood conditions changed.

The present levee system was started about 1882, and that year there were 284 crevasses, aggregating 56 miles in width, which indicates that this flood overspread the lower Mississippi Valley almost unrestrictedly. It became the flood of reference, with which other floods were compared. In 1884 there were 204 crevasses. In 1897, with the levees assuming some proportions, there were only 26 crevasses below Memphis. There were twelve crevasses in 1912, eight in 1913, two in 1922 and in the unprecedented flood of 1927 there were only five crevasses above Red River Landing, counting several that overtopped the levee at Bougere as one crevasse. On the Atchafalaya there were the Bayou des Glaises, Melville and McCrea crevasses. This decrease in the number of crevasses does not imply that overland floods have decreased, but it does show that the raising and strengthening of the levees have carried floods to much greater heights than in former years. The increase in flood heights against the levees has greatly increased the danger and destructiveness of floods; hence the forecasting of overland floods has become a matter of even greater importance to the general public than the forecasting of flood stages in the river channel.

To determine how rapidly the water traveled overland after leaving the main channel, with the assistance of Mr. McDonald, assistant forecaster, I checked the rate of travel of several overland floods. In the three floods of 1912, 1922 and 1927 (Fig. 3) the flood water returned to

the main channel through Old River at Red River Landing.

In 1912, after the Salem crevasse 211 miles above Red River Landing, the water stopped rising at Red River Landing in five days, showing a river channel travel of 40 miles per day, but it was fifteen days before the overland flood reached Red River Landing, 115 miles in an air line, a rate of travel a little less than 8 miles per day.

In 1922 the Weecama crevasse was 78 miles above Red River Landing; on the second day there was a slight fall at the Landing, and six days after the crevasse the water began to return at that place, showing almost the same rate of travel as in 1912.

In 1927 water from the Bougere crevasses returned on May 3. On that date crevasses occurred at Cabin Teele, 180 miles above, and at Winter Quarters, 150 miles above Red River Landing. The water from the overland flood from Winter Quarters appeared at Red River Landing on May 13, showing a rate of travel slightly less than 8 miles per day in a direct line. On May 15, when the Bayou des Glaises levee washed out, the overland flood was rising nearly a foot a day at Jonesville, 50 miles above; the flood crest was then seven days in time above Bayou des Glaises, and there would have been a further rise covering this period if the remaining levees had held the flood during that period.

Overland floods on the left bank in Mississippi travel at almost half the rate of the travel of the water in the river channel—that is, it requires twice the time for an

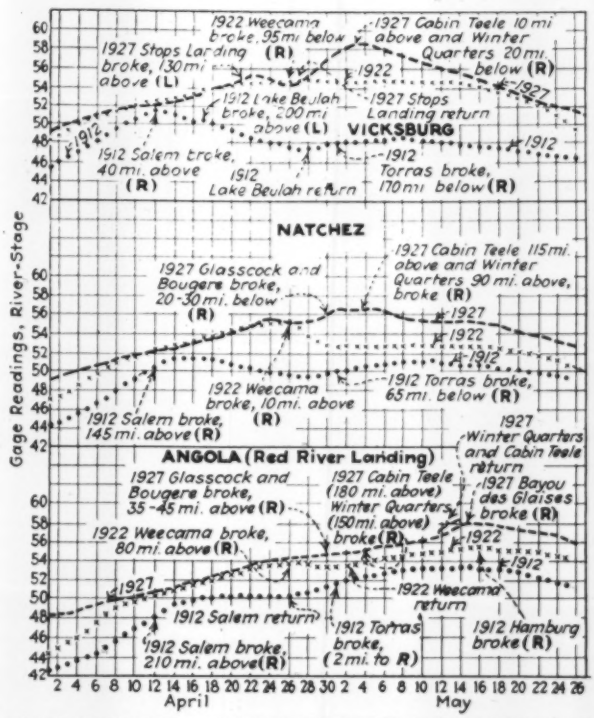

Gage Readings, River-Stage
1922 Weecama broke, 95 mi. below (R)
1927 Cabin Teele 10 mi. above and Winter Quarters 20 mi. below (R)
1927 Stops Landing broke, 130 mi. above (L)
1912 Lake Beulah broke, 200 mi. above (L)
1927 Stops Landing return
VICKSBURG
1912 Salem broke, 40 mi. above (R)
1912 Lake Beulah return
1912 Torras broke, 170 mi. below (R)
NATCHEZ
1927 Glasscock and Bougere broke, 20-30 mi. below (R)
1927 Cabin Teele 115 mi. above and Winter Quarters 90 mi. above, broke (R)
1922 Weecama broke, 10 mi. above (R)
1912 Torras broke, 65 mi. below (R)
1912 Salem broke, 145 mi. above (R)
1927 Winter Quarters and Cabin Teele return
ANGOLA (Red River Landing)
1927 Glasscock and Bougere broke, 35-45 mi. above (R)
1927 Cabin Teele (180 mi. above) Winter Quarters (150 mi. above) broke (R)
1927 Bayou des Glaises broke (R)
1922 Weecama broke, 80 mi. above (R)
1922 Weecama return
1912 Salem return
1912 Torras broke, (2 mi. to R)
1912 Hamburg broke (R)
1912 Salem broke, 210 mi. above (R)
April
May

FIG. 3—GRAPHICAL ANALYSIS OF CREVASSE EFFECTS AT THREE POINTS ON THE RIVER IN THREE FLOODS

overland flood to pass from the crevasse back into the river channel at Vicksburg that it requires for the water in the channel to travel to Vicksburg. Therefore when the flood crest in the river channel is below or near the crevasse which gives the overland flood, the increase in the channel stages at the point of return of the overland flood to the main channel is not as great as when the flood crest is above the crevasse. When the return of the overland flood to the main channel is coincident with the passage of the flood crest in the channel, the height of the flood crest at the point of return and below is materially increased.

1927 Forecasts—Last spring the flood forecasts up to April 30 had been based on known gage relationships considered in connection with the rainfall in the lower Mississippi drainage basin, but it was evident early in May that an overland flood of vast proportions would call for warnings and advices such as had never been issued for any previous flood. The 200,000 persons in the threatened area must receive warnings in terms that would result in prompt action.

There were no gage relationships and no precedents to guide. It was necessary to work out new premises and build a forecast structure along lines not previously used in flood forecasting. The elevations of the region over which the flood would travel were absolutely necessary if the people were to be warned as to the depth of water to be expected.

There were no topographical maps of the area. Mr. McDonald obtained from the railroads the elevations of their stations and the profiles of their lines, and these were reduced to a map as the groundwork on which to forecast depths of flooding. These topographical data, supplemented by reports of elevations of the water surface at points from the upper basin, gave information for estimating the volume of water flowing through channels and crevasses, and thus we were enabled for the first time in history to forecast time and depth of flooding. The accuracy attained is shown in the following:

May 17: Conditions now in sight indicate that the flood in St. Martin Parish along the M. L. & T., Lafayette and Baton Rouge branch line will be 17 to 20 ft. in the low bottoms and over the track in the vicinity of Breaux Bridge.

May 18: We consider it advisable to evacuate the remainder of all that area 15 to 20 miles wide along the west side of the Atchafalaya River south of Bayou des Glaises to and including Port Barre and the strip 15 miles wide west of the Atchafalaya below Port Barre to the Baton Rouge-Lafayette branch of the Southern Pacific Railroad. Residents of all towns on the Teche from Port Barre to Breaux Bridge should be on guard and ready for prompt evacuation if the situation demands.

There was a rise of 5 ft. at Breaux Bridge in the 48 hours ended on the morning of May 26.

May 19: The water should reach an average depth of about 8 ft. above the rails of the Southern Pacific branch line between the Lafayette highland and the Atchafalaya River and overflow the lowlands west of the Bayou Teche below that line down to and around St. Martinville, with water probably entering that town May 25 to 30.

The flood began flowing through St. Martinville on the morning of May 25, and on May 26 the town was flooded with water 2½ ft. over the railroad tracks at Port St.

May 21: It appears that the Teche will overflow its banks in the vicinity of New Iberia by June 1.

Flood water entered New Iberia May 26.

Six days warning in advance of the arrival of the flood water was given all along the line, so that the 200,000 people had time to move out with their property before the arrival of the flood. Another 100,000 in towns apparently threatened by the flood were advised that they could remain at home with safety and protect their property against the stages forecast for their localities.

To accomplish these results required twelve to eighteen hours of work a day for the greater part of May. If topographic maps had been available, the labor would have been materially lessened. Topographic maps should be prepared for the Mississippi Valley subject to overland floods.

Waterfront Foundation Complicated by Buried Log Cribs

Abandoned Subsurface Structures on Waterfronts Give Disproportionate Foundation Costs. A New York City Example

By Ralph H. Chambers
Consulting Engineer, New York, N. Y.

WATERFRONT property, as a site for heavy buildings, is of peculiarly uncertain value. Particularly is this true in long-settled localities. Where location is of prime importance, other considerations may be neglected, but in many cases more than the ordinary investigation should be made before such a site is selected. The preliminary investigation should be directed to determine whether adequate foundations can be obtained at a reasonable cost or whether buried obstacles may be encountered which may make the foundation cost an indeterminate and possibly a disproportionate factor.

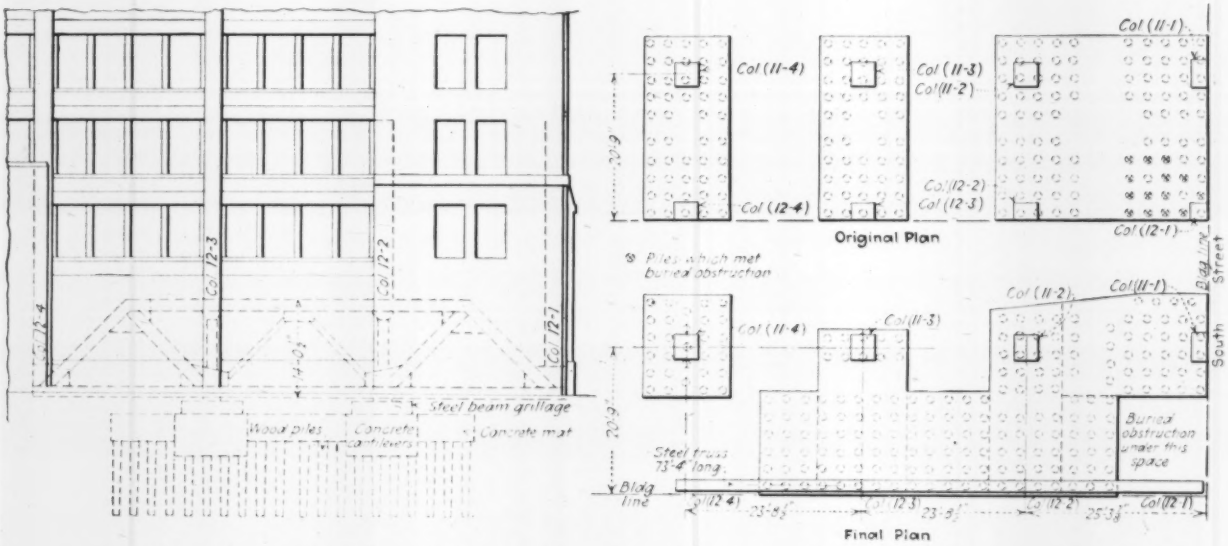


DIAGRAM OF SPECIAL FOUNDATIONS WHERE UNDERGROUND OBSTACLES STOPPED PILEDRIVING

As has been intimated, such unknown obstacles are usually the result of the long occupation of the locality. The shore line, as it now exists, is often far beyond its original location. The original shore line, with its piers and wharves, usually of stone-filled log cribs, and its abandoned and decaying hulks, was finally outgrown. The shore line was pushed out by filling and new waterfront structures were built. This has gone on until now a considerable area of waterfront property is underlaid with such abandoned structures, lying below the water level and buried under a fill of heterogeneous character. Such conditions, entirely hidden and often difficult to develop, add greatly to the cost of even the simplest form of foundation. The foundations for the Hearst Publications Building in New York City are an example.

This six-story building houses the publishing plant of the New York *Journal* and the New York *American*. It faces South St., and occupies the greater part of the block between South and Water Sts. and between Catherine and Market Slips. Only small areas at the southeast and northwest corners of the lot are not occupied by this plant, but an old warehouse, with a frontage of 155 ft. on Water St. and a depth of 92 ft., has been left standing and will be used for the storage of print paper. Therefore the new building has a frontage of 416.4 ft. on South St. and 238 ft. on Water St. On account of the paper storage warehouse, the building is virtually divided—in fact, is actually divided by an expansion joint—into a main building 238x145.6 ft. and a wing, fronting on South St., 178.4x51 ft. A tower rises above the roof of the main building just where it is joined by the wing.

The building is of reinforced concrete and the loads upon the foundations are unusually heavy for a building of this height, because of the heavy presses which occupy practically the whole of the ground floor of the main building and the wing.

Six preliminary wash borings, well scattered over the lot, were made on the site of the new building. These borings disclosed that the original bottom of the East River, under the site, consisted of firm, fine sand with some clay, and lay at depths of 24 to 41 ft. below water level. An old stream emptied into the East River at this point and, probably due to this, a deposit of soft silt, varying in depth from 8 to 19 ft., overlaid the original sand bottom. Over this silt a fill of sand and clay 11 to 30 ft. in thickness had been made. These borings did not encounter or show any timber, stone or unusual obstructions. Other borings, made near this site, showed that rock lay at a great depth below the surface.

As it was evident that the soft silt stratum would not carry any appreciable load, the solution of the foundation problem was apparently obvious—that is, the loads must be carried down through the fill and silt to the sand of the original river bottom. Timber piles, cut off just below water level, were chosen as a suitable and economical foundation. Eventually about 3,000 such piles were driven.

The specifications required that piles should have 7-in. tips and butts 12 in. in diameter 2 ft. from the ends. The specifications also required that piles should be driven by a single-acting steam hammer, with a ram of

5,000-lb. weight and a drop of 3 ft., and that the penetration of the piles under the last five blows should not exceed 4 in. According to the usual determination, this would insure that each pile would sustain a load of seventeen tons (the foundations were designed on a basis of fifteen tons per pile). However, as it was proposed to carry the loads through the fill and silt to sand below, and as it became evident that the friction of the piles in the fill absorbed a considerable part of the impact of the hammer, the specifications were changed, by agreement, so that the penetration under the last five blows did not exceed 2½ in.—the usual specification for piles intended to sustain a load of 25 tons each. Under this specification the piles reached a sufficient penetration into the original river bottom to sustain the required loads, as is evidenced by the fact that there has been no settlement of the building. But even so, the piles penetrated the sand a surprisingly short distance, usually not more than 3 to 5 ft.

The difficulties arose because, in many cases, the piles did not completely penetrate the fill above the silt stratum and therefore the load upon these piles, had they been loaded, would have rested upon the soft, semi-liquid silt. In many other cases the piles encountered logs, stone-filled cribs and other and unknown obstructions before they reached the sand river bottom. As has been stated, the preliminary borings did not show any buried obstables, but in the early part of the work a pit dug as a sump, on the part of the site now occupied by the wing of the building, uncovered a long, stone-filled crib which had been covered by the fill.

An attempt made to drive piles through this crib was unsuccessful, and as the cribs themselves were unsuitable as foundations, there was no other recourse but to excavate and remove the cribs where they interfered with the proposed foundations. Five such excavations were made, in cofferdams 9 ft. wide by 24 ft. long and down to a depth of about 20 ft. below water level. As the flow of water was very free and the logs and stone prevented the driving of the sheeting below the excavation to cut off the water, this task proved very troublesome, slow and expensive. Even after the cribs had been removed, so many stones were found, embedded in the sand below, that timber piles could not be driven and therefore iron pipes were driven, cleaned out and filled with concrete.

Under the tower there were no cribs or large stones, but the fill consisted of coarse sand and gravel through which the piles could not be driven even when shod and jetted—expedients that were frequently resorted to in this work. It was necessary to excavate, to a depth of 18 to 20 ft., in a sheeted and braced cofferdam about 40 ft. square before the piles could finally be driven through the fill and silt and into the underlying sand. In one case, where many of the piles of an oblong footing could not be driven, success was finally attained by relocating the footing at right angles to its original position. Where the piles of a cluster of 40 or 50 had been driven and an analysis of the driving records showed that some of the piles had not reached the required depth, it was only with the greatest difficulty that additional piles could be driven and these only by using shoes and long and heavy jetting. In all cases great care was used to drive the piles in such order that there was the least possible pocketing and compacting of the fill.

Many other cases of trouble from buried obstructions added to the cost and difficulties incident to this work, among which the following was one of the most perplexing: The piles near the southeast corner of the site were driving with less than usual difficulty when, after the piles for the footings for columns 11-1 and 11-2 had been driven, it was found that the piles under column 12-1 were bringing up on some obstacle in the fill above the silt. The sketch shows the original pile plan and indicates the piles that encountered the obstruction. At this point the depth to the original river bottom and the thickness of the silt stratum are unusually great. A series of additional borings showed that there was no possibility of driving any kind of piles in the space immediately adjacent to column 12-1. Finally it was decided to attempt to drive additional piles in the space between columns 12-2 and 12-3 and, if these could be driven to a proper depth, to carry the load at column 12-1, by cantilever, back to these piles. Before this decision was reached all suggested expedients were reviewed, including the sinking of a pneumatic caisson, as it was realized that the depth to be reached, the great amount of water to be handled and the character of the soil, as well as the presence of some buried obstacle, made an open excavation impossible.

It was found possible to drive piles as located on the revised pile plan. A steel truss, a full story deep and extending from column 12-1 to column 12-4, a length of about 73 ft., was used to carry the loads of four columns to the reinforced-concrete cantilevers at right angles to the truss, at columns 12-2 and 12-3. These concrete cantilevers, together with the concrete mat, carry the loads, a total of about 1,075 tons, to the piles. The truss was inclosed in a hollow concrete wall. This expedient, somewhat unusual in a concrete building, proved the quickest and cheapest way out of the difficulty.

These foundations were built by the Turner Construction Company, under the supervision of H. D. Hynds for the owner and F. E. Schilling for the contractor. M. J. Roach was the engineer for the contractor and George Smith was superintendent. The piles were driven by the Frederick Snare Corporation. Charles E. Birge was the architect, G. E. Pantacoast was the mechanical engineer and the writer was consulting engineer to the owner.

Use of Water Power Increases

During the quarter ended Dec. 31, 1927, applications to the Federal Power Commission for permits or licenses under the federal water-power act increased in number from 839 to 864. These 25 additional applications involved 234,000 primary horsepower and an estimated installation of 610,190 hp. The aggregate capacity of projects covered by applications pending and already granted on Dec. 31 was approximately 11,680,000 hp. and 25,822,000 proposed installations.

Railway Proposed From Stewart, B. C., to the Yukon Territory

An application has been made for a charter to construct a railway from Stewart, B. C., to the Yukon Territory, for the purpose of developing northern British Columbia, particularly the Atlin district. This will give a direct Canadian mail route to the Yukon Territory from deep water harbor at Stewart. The length of the road when constructed will be in the neighborhood of 500 miles.

Bridge 502 Ft. Above Stream Bed Built in Idaho

Highway Toll Bridge Across Snake River Canyon Has 700-Ft. Cantilever Span Built With Cableway and Travelers

By R. M. Murray
Chief Engineer, Union Bridge Company, Portland, Ore.

A HIGHWAY bridge, believed to hold the record for height above valley crossed, has recently been built across the Snake River Canyon in southern Idaho about 3 miles north of the city of Twin Falls. The roadway is 476 ft. above ordinary water level and 502 ft. above the stream bed. The bridge consists of two structural steel towers, supporting a central cantilever span of 700 ft., and two 225-ft. anchor arms. It was constructed as a toll bridge to replace 3 miles of road and a low-level toll bridge by which the canyon was previously crossed. The road replaced followed a zigzag route, and under favorable weather conditions an automobile the driver of which was familiar with the road required at least 30 minutes to descend into the canyon and climb to the opposite rim.

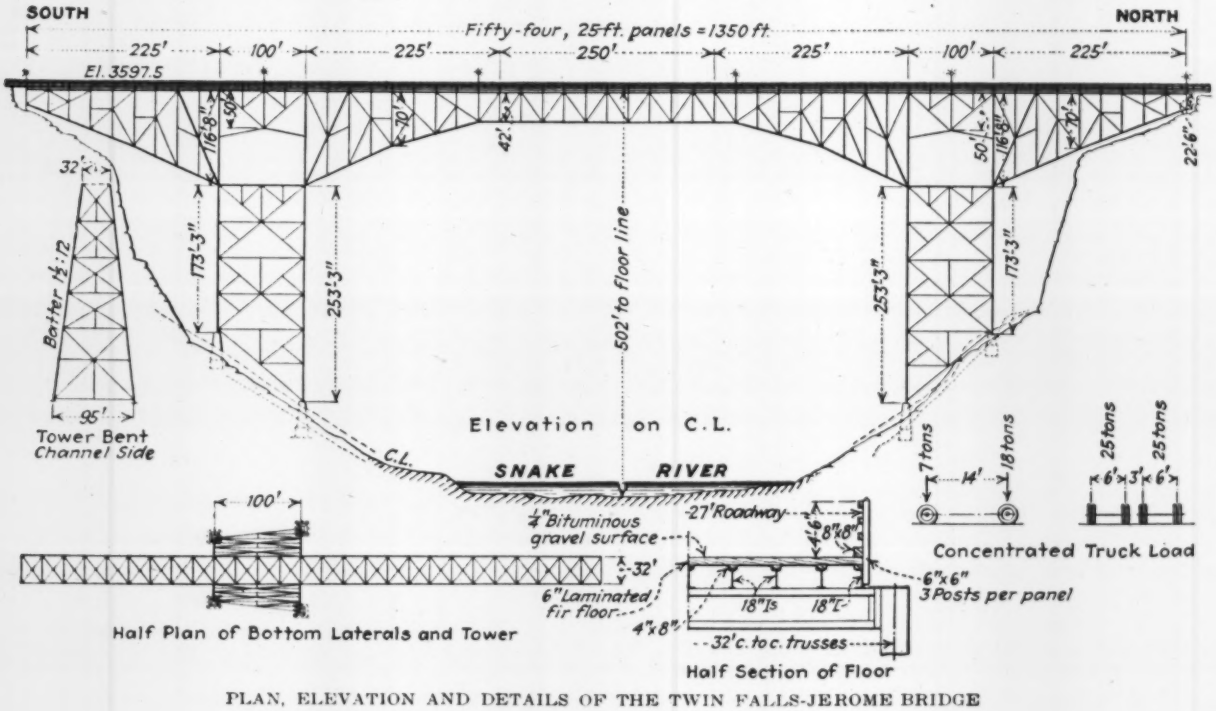
On both sides of the canyon lies fertile farm land, most of which is under intensive cultivation. The location selected for the bridge is at a narrow point in the canyon close to the established route between the cities of Twin Falls and Jerome, which is also the main north-and-south route for through traffic.

Despite the need for the bridge, it could not have been constructed with the limited funds available from state and county taxation, and hence on Dec. 31, 1925, a franchise was granted to the writer by the county commissioners of Jerome and Twin Falls counties, which two counties meet on the center line of Snake River. Construction on the approach roads was started in September, 1926, the first concrete in the bridge piers was poured three months later, steel erection began in April, 1927, and the first automobile went across the bridge on Sept. 1.

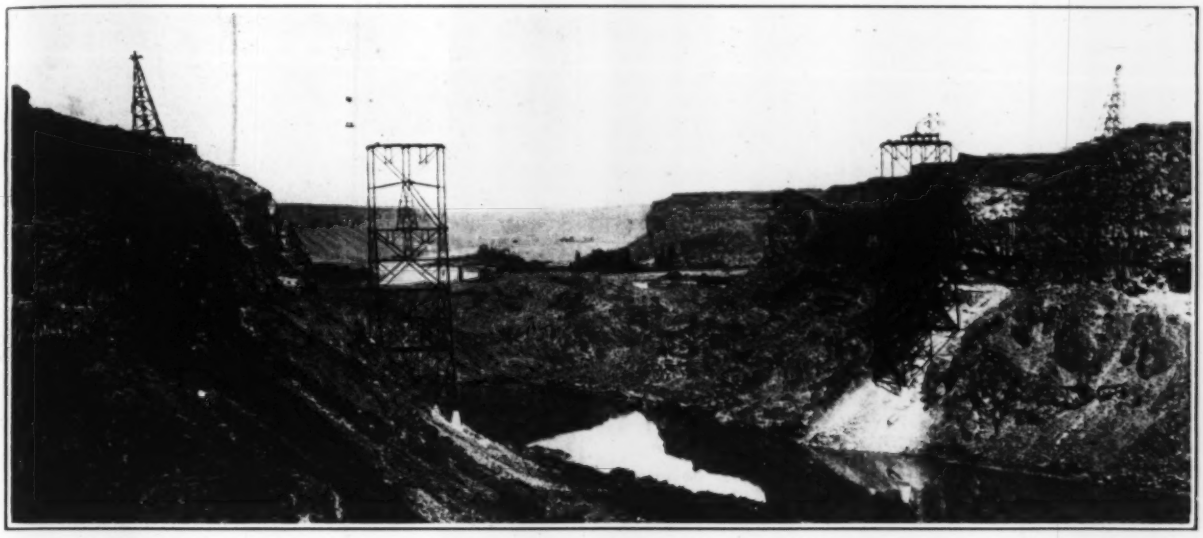
The total length of the structure is 1,400 ft. and the roadway, 27 ft. wide, is supported on trusses spaced 32 ft. on centers. The bridge deck is carried by 18-in. steel stringers, on which there is a 6-in. laminated floor of fir, covered with an asphalt wearing surface.

The uniform load for which the structure was designed varies, according to the distance loaded, from 1,700 to 1,200 lb. per lin.ft. The maximum concentrated live load was taken as two 25-ton trucks either abreast or moving in opposite directions, with axles 14 ft. on centers, the forward axle carrying 7 tons and the rear axle 18 tons. An impact increment of 20 per cent of the live-load stresses was included in proportioning the floor system, one-panel verticals and sub-diagonals. Expansion joints were provided at each end of the suspended span and at extreme ends of the bridge. The top-chord ties and bottom-chord struts used in erecting the suspended span are of telescopic construction with pockets for hydraulic erection jacks and spaces for shims in erection and in service.

The shore arm anchorages are of reinforced concrete set in the lava rock walls of the canyon. They contain steel grillages to which the steelwork is solidly anchored. The steel towers are supported on reinforced-concrete piers carried down to solid rock. Corresponding pier



PLAN, ELEVATION AND DETAILS OF THE TWIN FALLS-JEROME BRIDGE



TOWERS COMPLETED, READY FOR THE SPANS
Traveler being erected on tower at right under cableway delivering from either rim of the canyon.

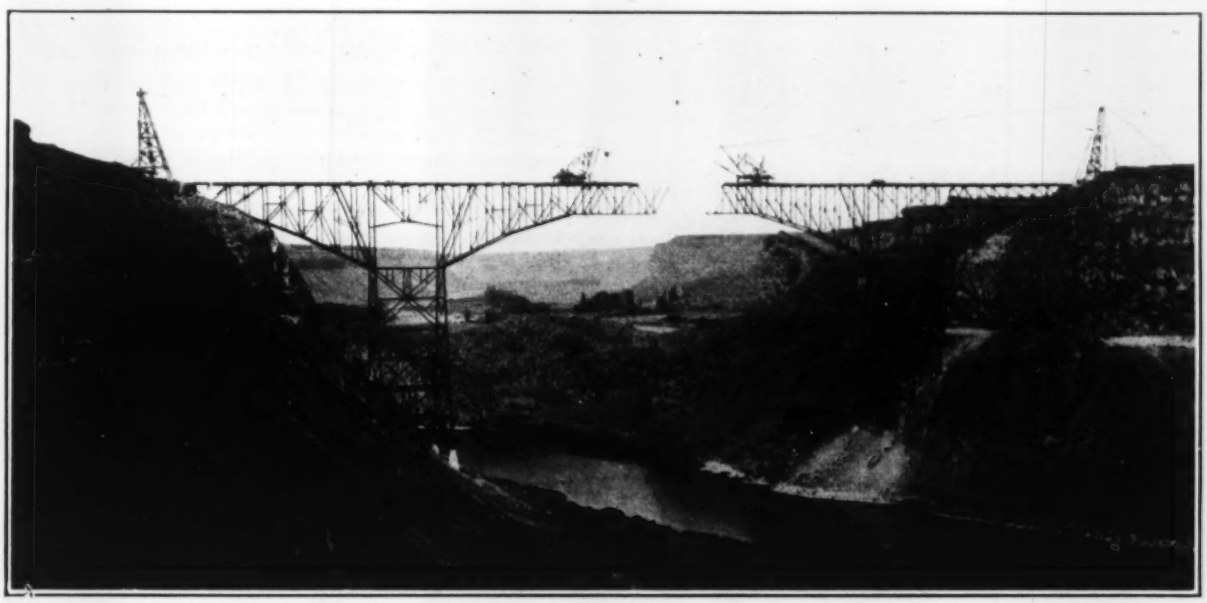
tops on opposite sides of the river are at equal elevations to simplify design of the steelwork.

An overhead cableway was used for much of the erection. This cableway was supported on timber towers 125 ft. high and 1,525 ft. apart, on opposite sides of the canyon. The main cable, $2\frac{3}{4}$ in. in diameter, is operated at an average sag of 75 ft. Cableway, carriage and other appurtenances were designed for an 18-ton load. Motive power was supplied by an 85-hp. electric hoist at the tower on the south side of the canyon.

A total of 2,900 tons of steel was used in the structure, of which about five-sevenths was delivered on the south side of the canyon, where the main steel yard was located convenient to the cableway. The steel was brought in on motor trucks and was unloaded by a skid derrick to push cars used for delivery about the yard or to the cableway.

The steel towers were erected by the cableway alone, but after the towers were brought up to full height travelers were set up on them and thereafter erection was carried on both by travelers and by cableways. The cantilever arms and suspended span were erected largely by travelers, one on each arm. Each of these travelers carried two 60-ft. booms and worked on a circular T-rail track designed for complete reversal. Steel erection was completed in 111 working days. When the closing members were placed at the middle of the suspended span, only very slight adjustments of the erection jacks were required.

In locating the center line, piers and control points of the structure, a double system of triangulation was employed, one base being located on the surface back of the canyon rim above the bridge floor and the other in the bottom of the canyon. The two bases of triangula-



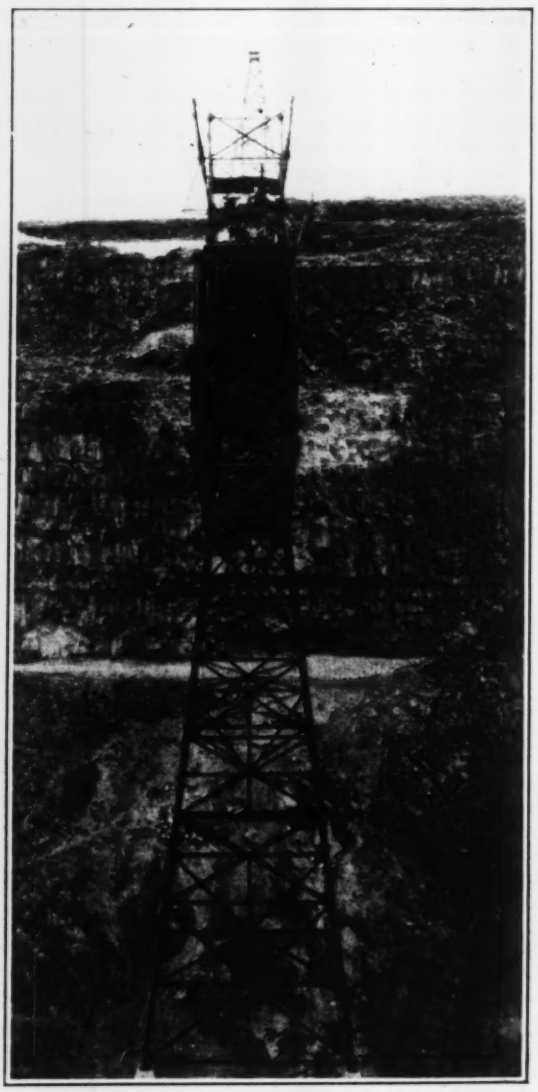
SUSPENDED SPAN IN PROCESS OF ERECTION
This part of the erection was done exclusively with the travelers, each of which was equipped with two 60-ft. booms.

tion were connected and checked by precise levels carried over a 1½-mile traverse.

The lengths of all main structural members, including some in the towers, were adjusted for deformation, pin play and camber. These adjustments were further disposed to reduce, as far as possible, secondary stresses in lateral members. In order to avoid slackness of diagonals in the towers when the posts had been fully stressed by dead load, certain of the tower field connections were merely bolted up until the superstructure was nearly all in place, after which riveting was completed. Small deformation adjustments were made in the lengths of some of the tower diagonals to facilitate erection.

A concrete mixing plant was erected on the south side of the canyon, and concrete for anchorages, tower piers and abutments was delivered by chutes or with the aid of the cableway.

The bridge is owned and will be operated under a 50-year franchise by the Twin Falls-Jerome Intercounty Bridge Company, Seattle. The structure was designed under the direction of the writer by the Union Bridge Company, Portland, Ore. The construction contract was held by the Puget Sound Bridge & Dredging Company, Seattle, for which L. G. Murray was construction superintendent. Erection was completed within schedule time and without serious injury to any workman. The steel, excepting the eyebars, was fabricated by the Wallace Bridge & Structural Steel Company, Seattle, and the eyebars were furnished by the American Bridge Company, Ambridge, Pa.



END VIEW OF TOWER AND SUPERSTRUCTURE

SKIP DELIVERING WORKMEN TO SOUTH TOWER

Straightening River Increases Pumping Cost

Increased cost of pumping water at the 179th St. pumping station, New York City, has resulted from widening the Harlem River. It was necessary to cut off the dock adjoining the pumping station where coal was unloaded from barges and conveyed to bins in the pumping station. Since the dock was removed, it has become necessary to haul the coal by truck at a cost of approximately one dollar per ton more than was formerly paid for delivery at the dock.

May Remove Shoals in St. Lawrence River

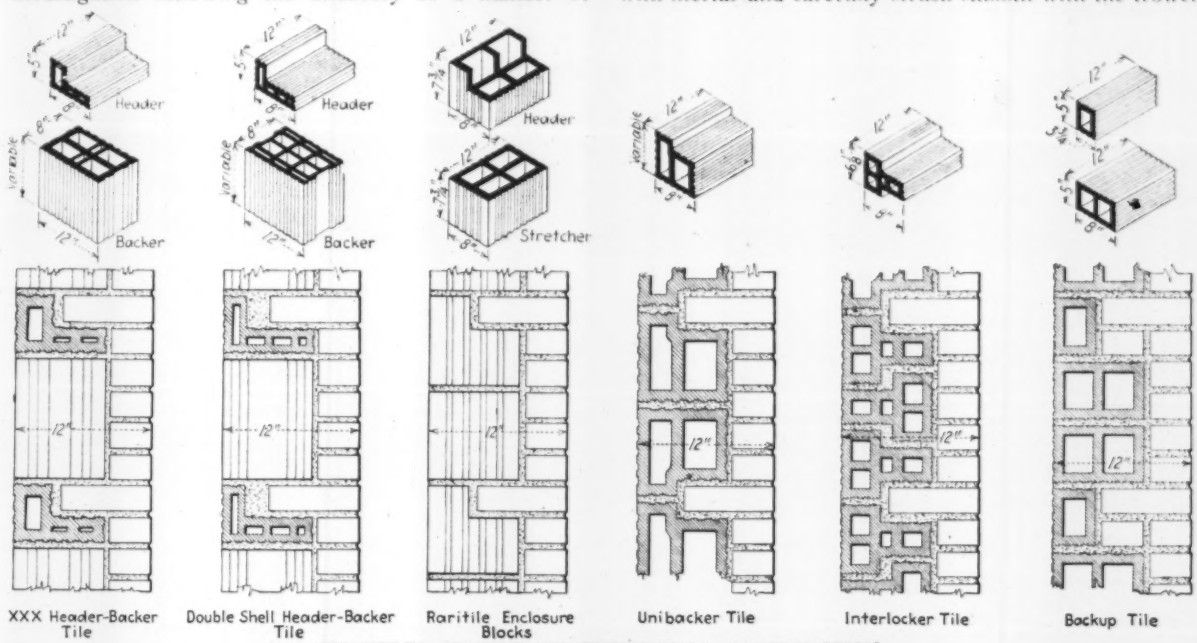
Under authority of the river and harbor act of March 3, 1925, a study has been made of the advisability and cost of removing shoals in the St. Lawrence River to provide a depth of 22 ft. between Ogdensburg, N. Y., and Lake Ontario. The estimated cost of the work is $214,500, of which $114,500 covers the operations required in Canadian waters. Inquiry has been made of the Canadian government through the Secretary of State to ascertain whether it is interested in an improvement of this nature.

Some Practices in Erecting Damp-Proof Tile-and-Brick Walls

Plenty of Dense Mortar Used—Roof Flashing Extended Into Parapet Walls—Spandrels Calked With Oakum

By P. H. Bevier
Engineer, Eastern Hollow Building Tile Manufacturers' Association

INCREASED use of skeleton framed buildings has occasioned a comparable increase in the development of exterior curtain wall construction, which in some instances is not proving satisfactory from a weather-proof standpoint. In New York City, construction practices with regard to exterior walls of brick and tile as used in some of the city's school buildings have been under investigation following the discovery of a number of leaking buildings. Carelessness in workmanship and disregard for recognized good practice are believed to have been the most important contributive causes.



EXAMPLES OF TILE-AND-BRICK WALL CONSTRUCTION

The special tiles required are the product of different manufacturers and are similar in general utility and adaptability to waterproof construction.

That weather-proof and dry exterior curtain walls can be constructed is evidenced by the large number of them that are functioning satisfactorily. Because of the constant general interest in damp-proof curtain-wall construction, this article has been prepared to review some of the best current practices in the use of composite brick-and-tile walls. It will be confined to the 12-in. exterior wall built of 4-in. brick facing and 8-in. hollow tile backing, bonded every sixth course by brick headers as required by most city building codes.

It may first be pointed out that the chief reasons for the increased use of tile in recent years are its light weight, its ease and speed of erection, its requirement of a minimum amount of mortar, its insulating value and its fire resistance. The accompanying sketches illustrate the various types of tile now in use. Whether to lay the tile with the cells horizontal or vertical is largely a matter of preference on the part of the contractor.

Moisture not only attacks a wall when accompanied by wind but will also travel by capillary attraction without wind pressure. Special attention should be given to the brick construction, because the most important place to attack water infiltration is on the outside of the wall. In the first place, the porosity and absorption or suction of a brick affects its bond to the mortar. It is desirable to have a brick with a moderately high absorption, one that will not only absorb the water in the mortar but take up some of the fine cement, which, entering the pores of the brick, creates a firm bond. Hard, smooth, non-porous brick effects very little bond with the mortar, in which case there will invariably be found shrinkage cracks between the brick and the mortar through which water can enter. On the other hand, care should be exercised not to use brick with a too high absorption, else it will crumble.

Joints on the face work should be thoroughly filled with mortar and carefully struck smooth with the trowel to compress the mortar, giving it maximum density and imperviousness. Raked-out joints or rough-cut joints for artistic effect are common causes for leaking walls. Machine-mixed mortar of 1 : 3 proportions, made of well-graded not too coarse sand and using hydrated lime equal to 15 per cent by volume of the cement, will give good results if care is used by the bricklayer to fill all the cross-joints as well as the bed joints. Mortar is more porous than tile or brick, and a tight wall cannot be expected if a lean mortar is used. Integral waterproofing mixed with the cement will lessen the absorption of the mortar but will not close shrinkage cracks or cure the effects of bad workmanship or poor mortar.

Before the tile are set, the back side of the face brick should be entirely covered with enough mortar to fill the space between the brick and the tile. For some years it was advocated that this space be left open on the theory that the moisture was carried through the wall by capillary action of the mortar, which is greater than that of the tile. This theory was abandoned, since it was found that such an open space freely admitted the water. Once

in, it could run down the back of the face brick until it reached the brick headers and then find its way to the plastering.

In setting the tile, care must be taken to fill and strike smooth all inside joints. Furring is always advantageous but expensive, so that in many cases recourse is had to waterproofing applied to the tile or brick. There are several brands of waterproofing on the market and the builder should satisfy himself as to their reliability. In any case the plastering must follow up the waterproofing while it is still tacky so as to assure proper adhesion. Depending upon the type of waterproofing, it is applied as a mastic about ⅛ in. thick with a trowel, as a semi-mastic applied in two coats with a roofer's four-knot brush, and as a paint applied by brush or spray. The latter is in most cases practically useless. A method eliminating the use of plastic waterproofing entirely involves the application of a scratch coat of waterproofed cement mortar to the tile or brick. This has not been largely used but has merit.

In addition to water infiltration directly through the walls, dampness enters through improperly built parapet walls and through the brick facing of spandrel beams and girders. Parapet walls should always be built of solid brick and with special care, since they are exposed on both faces. If the brick are not laid with shoved joints and if the inner course is not grouted solidly, the water will run down the inside cross-joints, passing outside of the roof flashing, and enter the concrete roof slab. An effectual method of shutting off the downward travel of the water into the roof slab and the wall below is to extend the roof flashing into and across the parapet walls to within 1 in. of the outside face of the wall. Watertightness around windowframes and under windowsills can be certainly secured only by calking with oakum before the plastic cement is applied.

Hydro-Electric Progress in Canada During 1927

THE Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has prepared a bulletin giving a review of hydro-electric and water-power development in that country during 1927, which shows that the activity in hydro-electric and water-power development continued without abatement during 1927 and that sufficient undertakings are either under construction or in early prospect to insure substantial progress being maintained in 1928 and the years immediately following.

In 1927 hydro power equipment was installed ready for operation to the extent of 221,655 hp., and other undertakings were advanced to such a stage that a further total of 378,000 hp. will be in place during the first six or seven months of 1928. With the additions during the year the total installation in Canada had grown to a figure of 4,777,921 hp. at the end of 1927, which will shortly be raised to more than 5,100,000 by the installations now in process of completion.

In British Columbia the principal activities of the year were carried out by the West Kootenay Power & Light Company and by the subsidiaries of the British Columbia Electric Railway Company—namely, the Burrard Power Company, Ltd., the Vancouver Island Power Company, Ltd., and the Bridge River Power Company, Ltd. The last-named company carried on extensive preparatory work in connection with the Bridge River project, which when completed will be the largest development in the province. Roads, camps and construction plants were proceeded with and early in October a contract was awarded for the construction of the tunnel leading from Bridge River to the power station site on Seton Lake. This tunnel will be 13,200 ft. in length and 12 ft. in diameter.

In the Province of Ontario the transmission line which the Ontario Hydro-Electric Power Commission is building to carry power from Fitzroy Harbor, on the Ottawa River, to Toronto and southwestern Ontario is of outstanding interest. This line, which will be more than 200 miles in length, will operate at 220,000 volts, the highest voltage of any line in the dominion, and will deliver the 260,000 hp. which the commission has contracted to take from the Gatineau Power Company at the Ontario boundary. The commission is carrying out the construction work by its own organization and expects to have the line completed and ready for operation by September, 1928.

On the Mattagami River in northern Ontario the Spruce Falls Company made rapid progress on its development at Smoky Falls. The initial installation of 56,250 hp. is expected to be ready for operation by August, 1928, when power will be transmitted to the company's pulp and paper mills at Kapuskasing.

In the Province of Quebec the Mercier Dam, creating a storage reservoir of 95,000,000,000 cu.ft. on the Gatineau River, was completed and filled early in the year under the direction of the Quebec Streams Commission. This project was for the benefit of various plants on the Gatineau River.

In New Brunswick on the St. John River at Grand Falls the St. John River Power Company, a subsidiary of the Canadian International Paper Company, actively pressed the construction of its development which is designed to have a capacity of 80,000 hp. in four units of 20,000 hp. each, operating under a head of 130 ft. At the end of the year the dam, power station, tunnel, intake and penstocks were practically completed, and it is expected that one unit will be in operation by July, 1928.

Typhoid Fever Declined in 1927

Total cases of typhoid fever for 50 weeks of 1927, as reported by the health officers of 36 states, numbered 22,400, compared with 25,500 cases in 1926 and 30,700 in 1925, according to the U. S. Public Health Service. The 36 states have a population of about 88,000. Both case and death rates for typhoid fever were higher in 1925 than for the three years 1922, 1923 and 1924, but the 1925 rates were lower than any recorded before 1920. From 1900 to 1926 the typhoid death rate in the registration area of the United States dropped from 35.9 to 6.5 per 100,000.

Columbia River Basin Studies Continued

A large reservoir site on the south fork of Flathead River near Kalispell, Mont., has been surveyed by engineers of the Geological Survey engaged in classifying public lands. This reservoir could be used to supplement Flathead Lake in storing water to develop power on Flathead River, Clark Fork and Columbia River, and also for the irrigation of lands in the proposed Columbia Basin project in Washington.

Engineering Literature

A Monthly Review of Books and a Listing of New Publications

Water Purification Studies

REVIEWED BY NORMAN J. HOWARD
Bacteriologist in Charge of Water Purification, Toronto, Ont.

STUDIES OF THE EFFICIENCY OF WATER PURIFICATION PROCESSES—I. Results Obtained From a Preliminary Study of the Cincinnati and Louisville Municipal Filtration Plants. II. and III. Results Obtained From a Collective Survey of Seventeen Municipal Filtration Plants. By Sanitary Engineer H. W. Streeter, U. S. Public Health Service. Public Health Bulletin No. 172, U. S. Public Health Service. Paper; 6x9 in.; pp. 423; diagrams on folding plates and in text; 69 tables. $1 from Superintendent of Documents, Washington, D. C.

To the consultant who is asked to report upon the location of a new plant or the modernization of an old one such information as is contained in this report may be of material value; to the water-works engineer, superintendent, chemist or plant operator called upon to operate the plant, the records of other plants and statistics as to the permissible physical and bacterial loading of purification works are great aids in determining not only the efficiencies of various processes involved, but in controlling the final purification of their water.

The report presents the results of observational surveys of the bacterial efficiency of ten municipally owned water purification plants on the Ohio River and seven other plants located in various parts of the country, together with a comprehensive study of the relations existing between the pollution of raw water supplies taken for purification from streams receiving sewage and other wastes and the sanitary quality of effluents produced from such sources of supply by current processes of water purification.

Considerable space is given preliminary studies of the Cincinnati and Louisville plants made in 1915 and 1916. Clearly defined relations are noted as existing between the bacterial variations in the quality of the raw water and the purification effected in the different stages of the filtration process. The preliminary studies indicated the most profitable methods to be followed in further studies of the question, and that the maximum permissible B. coli index of the raw water permitting the production of a filtrate conforming to the original U. S. Treasury Standard (2 B. coli per 100 c.c.) was 630 B. coli per 100 cubic centimeters.

The studies of 1923-24, dealing with the additional plants on the Ohio River and elsewhere, were undertaken to investigate the raw water conditions being encountered and the results of purification being obtained at a series of plants along a single highly polluted stream affording a common source of raw water supply, and to study a number of isolated examples, each one typical of a different though fairly representative problem. Elaborate physical, chemical and bacteriological studies were made of the raw water and effluents, and detailed figures are given. Reference is made to the marked reduction in turbidity and bacteria effected by primary sedimentation, to the relatively low range of variation in the turbidity of the raw water in the Ohio plants, which averaged 16 p.p.m., and to the mean B. coli content of the unchlorinated and chlorinated filter effluents, averaging 2.6 and 0.4 per 100 c.c. respectively.

A summary of Part II includes the present status of bacterial pollution of the Ohio River, the quality of effluents produced, the efficiency of purification shown by the plants of two general types, together with the limiting bacterial content of the river water which is safely consistent with the production of effluents of specified bacterial quality. Part III deals with several plants located at various points elsewhere than on the Ohio River. The greater difficulty of effectively purifying relatively clear but highly polluted water overflowing from the Great Lakes is gone into in some detail.

Only tentative conclusions are offered. These show that the water purification plants operating along the Ohio River are unable under existing conditions of pollution to produce unchlorinated effluents conforming, on the average, to the revised Treasury Standard, but by the continuous and effective use of chlorine as a post-sterilization process they were able for a large part of the time to meet the standard. With one exception, all of the plants located elsewhere than on the Ohio River were able to meet the Treasury Standard with the aid of chlorination. As judged by the average tolerance limit, the plants at Albany, N. Y., and Chester, Pa., were shown to be grossly overburdened by raw water pollution.

The report is of unusual value to sanitarians in general and Mr. Streeter is to be congratulated on the completeness and clarity of his presentation.

Concrete in Architecture

ARCHITECTURAL DESIGN IN CONCRETE—By T. P. Bennett, F.R.I.B.A. The Photographs Compiled by F. R. Yerbury, Hon. A.R.I.B.A. New York: Oxford University Press, American Branch. [Printed and made in Great Britain.] Cloth; 9x11 in.; pp. 25; 100 halftone plates. $10.

In one of those all too rare combinations of a minimum but sufficient text and ample illustrations, Mr. Bennett has dealt admirably with a subject of large and rapidly growing importance, "Architectural Design in Concrete." The book deserves perhaps even more welcome by engineers than by architects, for many of the handsome plates show engineering structures and industrial plants for the design of which as a whole engineers are more commonly employed than are architects, whichever may have had chief responsibility in the subjects presented in this volume.

Mr. Bennett's text (25 pp.) is well conceived and executed. First it sketches background as regards the growth of architectural styles to suit various countries, times, materials and corresponding artistic and technical development. Then it deals with various aspects of concrete as a building material of today, taking into account rather tacitly its changed possibilities through steel reinforcement and recognizing also its great adaptability in form—both bulk and surface—because of its plastic qualities. Some of the topics into which the text is divided and under which specific buildings are discussed are verticality, "wide" span in design, columnless interiors, vaulting, commercial interiors, proportion and subdivision, simplicity, ornament, texture, "crazing," ex-

posed aggregates, acid treatment. Bridges and domes are briefly considered.

Comparatively few bridges are pictured, and except for three or four of these, all designed by the same engineer, and one or two other structures, all the design work is credited to architects. This is natural in text by an architect and with views from photographs collected by another architect. Without wishing to rob architects of their due, a glance through the hundred views makes evident that engineers must have had at least equal responsibility with architects in many of the designs. But the author neither belittles nor berates the engineer for lack of artistic perception, as some other architects have done.

American architects have no cause to complain of having been overlooked in the collection of views. They are well represented from New York to California; perhaps with undue preference for architectural work in the latter state.

Altogether the volume is a most creditable one and promises to be highly useful. We commend it particularly to many engineers throughout the world who are engaged in the design of concrete buildings. It is equally deserving of attention by architects.

Stresses, Graphical Statics and Masonry

Reviewed by

Dr. W. K. Hatt and E. L. Ericksen
Respectively, Head, School of Engineering, and Associate Professor of Structural Engineering, Purdue University, Lafayette, Ind.

STRUCTURAL ENGINEERING: Stresses, Graphical Statics and Masonry—by George Fillmore Swain, LL.D., Gordon McKay Professor of Civil Engineering in Harvard University; formerly Chairman of the Boston Transit Commission and Consulting Engineer of the Massachusetts Railroad Commission; Past President Am. Soc. C.E., Member Inst. C.E., Am. Soc. M.E., Eng. Inst. of Canada, Am. Soc. for Testing Materials, Am. Ry. Eng. Assoc., Boston Soc. C.E., National Academy of Sciences, Etc. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 525; 440 halftones and line cuts. $5.

Dr. Swain's third volume in his series of five on Structural Engineering is characterized by the same qualities as were commended in the review of the first two volumes [by Dr. Hatt, *Engineering News-Record*, June 15, 1925, p. 120]—namely, no intellectual superstition but rather a searching examination of the foundations of the splendid structure of traditional mechanics; clear textual statements accompanying algebraic complications; and an abundant documentation which shows that the author has consulted recent authorities at home and abroad. The reading of this treatise is a pleasure to one who is impatient of an imposing array of symbols alone. The author's arguments are salutary in that the student may know that matters are not settled by the dictum of the writer of a routine textbook. The arrangement of contents is unusual in that the analysis of framed structures by graphical and analytical methods usually found in a junior course is bound in with a treatise on masonry structures relating to such matters as earth pressures, piers and abutments, and dams.

There is a very clear discussion of loadings for which structures should be designed. The standard Cooper loadings for bridges are given and also the moment loadings as suggested by Dr. D. B. Steinman—a valuable addition inasmuch as these loading diagrams are in closer agreement with the present-day heavy locomotives. The chapters on trusses present the usual methods of determining stresses in members, and repeatedly point out that the different methods are simply different ways of applying the fundamental equations of equilibrium. There is an excellent explanation of how the loads are carried through the truss by the several members and delivered to the supports. In short, throughout the whole discussion there is great evidence of the author's life-long teaching experience in that he signalizes difficulties which come to a student. Another outstanding feature of Chap. IV to VIII is that not once has the author used any trigonometric function as such; everything is computed from the geometrical properties directly. While this may be going to the extreme, it is gratifying to read a book in which the simple relations between forces in simple trusses are handled without an array of long trigonometric equations. The author presents the graphical method second, whereas in most other texts it appears first. Chap. IV deals entirely with the economics of simple trusses and points out very clearly the relation between mathematical economy and practical considerations, such as fabrication and amount of material. The author's numerous references to publications for further study will be appreciated.

The volume contains but little reflection of the author's views, recently expressed, upon the wisdom of building in a material that is generally characterized as permanent, although he prepares us for a discussion of this subject in Vol. IV. Thus on p. 253, in a chapter on Dimensioning, he tells us he is not in agreement with the stresses fixed by the Joint Committee on Concrete and Reinforced Concrete and so will not quote them, reserving comment for the forthcoming volume. This we may await with piquant interest.

The chapters on Wind Pressures, on Repetition of Stress, on Impact and Earth Pressures are particularly valuable. The treatment of cohesive earth follows the method of Prelini. There is a clear definition of active and passive pressures. The author recommends Rankine's analysis and points out the fallacy of the usual "wedge of rupture" method in which assumed pressure from the wall is taken at an angle with the normal equal to the angle of friction, whereby the three forces acting on the wedge will not meet at a point.

Saturated earth, hydraulic and hydrostatic pressure enter into the discussion. As in other chapters of the book the history of development of the analysis, and the account of apparatus and results of experiments present a thought-compelling background. One would suppose that the description of stone cutting and surfacing tools is at present of only encyclopædic interest. The treatment of retaining walls follows the usual course. That of piers and abutments is rather brief.

The author believes that the elastic theory, in spite of its appearance of greater accuracy, is not of greater advantage than Winkler's simple criterion. The author, a pupil of Winkler, introduced this criterion in 1880. The reviewers like the following (p. 415): "I believe I could have convinced him [Professor Winkler], though he was a good deal of a theorist, and often inclined, in my opinion, to carry theory too far. My own mind, however, was satisfied, and that was enough for me."

In the author's opinion the elastic theory is not properly applied to reinforced-concrete arches, which had better be increased in thickness of plain concrete if cracks are to be avoided (p. 424). The author points out that the normal stress on a horizontal plane taken in a dam is not the maximum stress, which latter is to be found on a plane perpendicular to a free surface.

No one interested in the design of masonry structures can fail to be enlightened, and put on his guard against

conventions, by reading this admirable treatise, the work of ripe scholarship and rich experience in construction.

The work of the reviewers has been the more pleasant in that consideration of a type of construction upon which the author's opinions may be extreme, because driven by controversy, are happily postponed, except in isolated instances, to a fourth volume.

Plumbing as a Branch of Engineering

PLUMBING—By Harold E. Babbitt, M.S., Professor of Sanitary Engineering, University of Illinois. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 455; 203 half-tones and line cuts. $5.

Plumbing as here presented is entitled to be classed as a branch of engineering—but we hasten to add that this does not warrant every plumber calling himself an engineer. As would be expected in any book by a professor of sanitary engineering, and especially in one by a conductor of research work for the Hoover Committee, the author adopts the Recommended Minimum Requirements for Plumbing in Dwellings and Similar Buildings, published in 1923 by the Department of Commerce. It may be added that Professor Babbitt, acting under the direction of the Illinois Department of Health and in co-operation with a committee of the Illinois Master Plumbers' Association, prepared the plumbing code recommended by the Illinois department just named.

Besides containing everything on the principles and practice of plumbing work that could be reasonably expected, this volume goes sufficiently into water supplies and sewerage to give students, plumbers and engineers not versed in those subjects sound knowledge of their fundamentals, including both water and sewage treatment. There are separate chapters on the Physics of Plumbing Systems, on Materials, on Dimensions, etc., as well as on the various classes of plumbing fixtures. Of two appendixes, one gives extracts from plumbing specifications and the other presents a long series of definitions of plumbing and allied terms.

The book is a notable contribution to both industrial and engineering literature. It deserves a place in the library of every sanitary engineer, health or other officer in charge of plumbing permits and inspection, and technical school, as well as in all public libraries, large and small.

Additions to Strange's Irrigation

PRINCIPLES OF IRRIGATION, ROADS and Buildings, and of the Water Supply of Towns—By William Lumsden Strange, M.Inst.C.E., Chief Engineer in Sind (retired). Second and Enlarged Edition. London: George Routledge & Sons. Cloth; 6x9 in.; pp. 896; 288 line cuts. 42s. in England.

The first edition of this book (under a slightly different title) was reviewed in these columns Sept. 15, 1921, p. 458, by F. W. Hanna, with commendation centered on the section (588 pp.) devoted to irrigation. The body of the present edition remains substantially unchanged, but the various portions of the original text are supplemented by an appendix of 45 pp., containing 51 separate notes, with page references to and from the main text. Most of these notes are on dams, reservoirs, canals and accessories and river control. They add to the value of the book as a whole but not sufficiently to make it worth while for many of the owners of the original edition to discard it and pay the price of the new edition —42 shillings in England and presumably $15 or more in the United States, tariff, postage, etc., included.

Russian Book on Flat Slab Floors

Reviewed by
LEON S. MOISSIEFF
Consulting Engineer, New York City

REINFORCED-CONCRETE FLAT SLAB ROOFS: Calculation and Structures [In Russian]—By Engineer-Professor John Podolsky, Mashcof Perenlok, D I K 7, Moscow Center. Moscow: State Publishing. Boards, cloth back; 6x9 in.; pp. 312; tables and 108 line cuts in text. 5.1 roubles.

The author of this work on Reinforced-Concrete Flat Slab Floors is a well known Russian professor of engineering. He has published during the last quarter of a century several valuable books and many papers on structural engineering. His works on Reinforced Concrete Bridges and Viaducts and on Trusses Without Diagonals were reviewed by me in *Engineering News*, May 17, 1906, and June 17, 1909. The present book maintains the high level of the author's previous works.

The author presents a complete critical discussion of all of the known theories of flat slab design. Engineers who have wrangled with the problem appreciate the difficulties the author has had to overcome. After developing in full the theory established by Grashof for a continuous plate supported on single intermediate points, the author discusses the methods of Eddy, Hager, Doeinck, Lewe, Marcus, Nichols and Westergard. He then compares their results with the American Joint Committee specifications and those of the German Commission and the Russian Government. A tabulation of the results obtained from all these methods and specifications as well as of elaborate tests made by Probst at Rotterdam, Holland, in 1924 shows at sight the discrepancies between them. In short, few of the resulting moments agree with each other. The American specifications result in moments about 50 per cent smaller than those of the German. The theoretical results hardly agree with the experimental observations. The author takes advantage of this comparative study to propose a simplified method of computation which gives results more in agreement with our Joint Committee than with the German Commission.

The rest of the book is devoted to a description of tests on continuous slabs made in Moscow, the United States, and Rotterdam; to the design and details of the steel reinforcing, and to the exposition of the author's simplified procedure. Tables of moments and reactions for various numbers of spans are appended thereto.

Professor Podolsky's work is the most comprehensive book on flat slabs yet produced. He treats the subject firmly and clearly and at all times keeps in mind the practical requirements and limitations. It is pleasing to find that such good engineering work is being done in the Soviet Republics.

French Handbook on Reinforced Concrete

BETON ARME — Par Victor Forestier, Ingenieur-Constructeur (A. et M.) M.Soc.Ing. Civils de France. Flexible binding; 4x6 in.; pp. 356+XXXII; line cuts and tables. 17 francs.

An unusual amount of general and special information is contained in this volume on "Reinforced Concrete," which is one of a series of handbooks on a wide variety of technical subjects issued by the same publisher. The book is divided into ten parts: Formulas and diverse information; calculation of bending moments; official regulations governing design and construction of work in reinforced concrete; material plant layout and formwork; calculation of reinforced-concrete structures; in-

dustrial construction; bridges, dams and retaining walls; conduits; reservoirs; standpipes and silos, and hydraulic work. Each of these ten divisions is broken up into miscellaneous chapters. The volume appears to be a well-balanced combination handbook for the designer and builder.

Local Monograph on Marine Borers

MARINE BORERS and Their Relation to Marine Construction on the Pacific Coast: Being the Final Report of the San Francisco Bay Marine Piling Committee, Co-operating with the National Research Council and the American Wood-Preservers' Association—C. L. Hill and C. A. Kofoid, Editors-in-Chief. San Francisco, Calif.: Published by the Committee; for sale by University of California Press, Berkeley, Calif. Paper or cloth; 8x11 in.; pp. 357; 45 tables and 143 illustrations, including folding map and other plates, halftones and line cuts in text. $4 in paper; $5 in cloth.

Attacks of marine borers on piling along the San Francisco waterfront having increased in activity and resulting damage from 1914 to 1920 led to the formation of a large and representative committee to study the whole subject. The final report now available is an interesting and valuable monograph, in five sections: (1) Historical, the formation and work of the committee being reviewed by Mr. Hill, one of the editors, and the development of marine structures in San Francisco Bay by R. M. Neily. (2) Hydrographic, by C. E. Grunsky. (3) Engineering, by Mr. Neily and W. H. Kirkbridge and four collaborators. (4) Chemical, by W. D. Ramage and J. S. Burd on chemical investigations, and R. C. Miller and Mr. Hill on exposure tests of special protection measures. (5) Biological, by M. Kofoid, one of the editors, and Mr. Miller, with four collaborators.

Aside from the main subject, which will be of special interest to many engineers and harbor authorities throughout the world, the historical information of San Francisco harbor, with its well-chosen illustrative views, will have broad general interest. The report as a whole is a credit to the committee, to the collaborators mentioned in the title page heading and to many other contributors to the committee fund, representing railroad, shipping, bridge, lumber, creosoting, copper, oil and other industrial interests.

Burton on Water-Works Revised

THE WATER SUPPLY OF TOWNS AND THE CONSTRUCTION OF WATERWORKS: A Practical Treatise for the Use of Engineers and Students of Engineering—By W. K. Burton, Assoc. M.Inst. C.E., Late Professor of Sanitary Engineering in the Imperial University, Tokyo, Japan, Sanitary Engineer to the Home Department, Japan. Fourth Edition. In Two Volumes, I—Collection and Purification Works. II—Works and Distribution. (Revised by J. E. Dumbleton, Assoc.M.Inst. C.E.) London: Crosby Lockwood and Son. Cloth; 7x10 in.; pp., Vol. I, 137, Vol. II, 160; numerous plates and other illustrations. 25s. per volume in England.

In revising the late Prof. Burton's book on municipal water supplies, Mr. Dumbleton has confined his material changes to the chapters on water treatment and on pumping. These and various minor changes bring the volume as nearly to date as can be expected of a revised edition of a book first published twenty years ago. The treatment throughout is primarily British in character, broadened by the experience of Prof. Burton in Japan.

Frequent references are made to American practice but some of these lag far behind the present day. Thus no hint is given of the fact that in this country rapid or mechanical filter plants have always exceeded slow sand in number while for years past nearly every new filter installation has been of the mechanical type. It is not surprising, but true, that the reviser is quite unaware that old slow sand filters at Providence, R. I., have given way to mechanical filters. It is more surprising that he appears to be unaware that for twenty years nearly all American and Canadian mechanical filters have been of the gravity rather than the pressure type.

If, as may be reasonably assumed, incomes of British engineers are considerably lower than those of American, one would suppose that the price set on the two volumes (25s. each, in England) would restrict sales in England to a low figure. The first edition was in one volume—unnecessarily thick because of large type, wide margins and many folding plates of line cuts. Nearly all the cuts might have been reduced to go in the text and still be legible—especially as the text is nearly 5 in. wide and the cuts have little lettering. As the present two volumes, combined, make up only some 300 pp. there seems little justification for setting them up in two sets of covers, unless it be that some purchasers will want only one of the volumes, the division being into (1) collection and purification and (2) distribution.

Notwithstanding the $15 to $18 which the two volumes will cost in this country (including tariff, postage, etc.) they may well find a place in technical and the larger public libraries and on the shelves of such engineers as can afford them as something of a luxury and are interested in comparative engineering. Those who already have any of the earlier editions (first to third very much the same) will be warranted in buying the present edition for the new material which it contains.

Publications Received

IN CIRCULAR No. 19, U. S. Department of Agriculture, entitled Forests and Floods, by Ward Shepard, Forest Service, some of the elementary aspects of the subject are presented from the forestry viewpoint.

A FOURTH EDITION, revised to January, 1928, of A. E. Buck's Administrative Consolidation in State Governments has been issued by the National Municipal League, 261 Broadway, New York City.

A REVISED EDITION of the Directory of Commercial Testing and College Research Laboratories, compiled in the U. S. Bureau of Standards, may be obtained for 15c. from Superintendent of Documents, Washington, D. C.

ARTICLES ON THE SEWERAGE SYSTEM OF BALTIMORE, chiefly from *Engineering News-Record*, have been reprinted as an illustrated 89-p. pamphlet and presumably may be obtained from the Bureau of Sewers, Baltimore, Md., M. J. Ruark, sewerage engineer.

TRAVEL IN BOLIVIA and consequently the cause for better highways is being sponsored by the recently formed Touring Club Boliviano (LaPaz, Bolivia). It has recently begun the publication of a monthly bulletin dealing with its activities, which can be obtained on application.

IN MUNICIPAL STATISTICS, 1926, the Ontario Bureau of Municipal Affairs presents tabular information regarding the financial operations, the water-works and the gas systems of the municipalities of the province named. (Paper; pp. 75. 25c. Address the Bureau, Toronto, Ont.)

THE FLOODS OF 1927 IN THE MISSISSIPPI BASIN is the subject of Supplement 29, Monthly Weather Review. An introduction by H. C. Frankenfield, senior meteorologist, is followed by eight reports by as many meteorologists. (49 large pages, with half tones and map in pocket; 25c. from Superintendent of Public Documents, Washington, D. C.)

MANY STATE HIGHWAY DEPARTMENTS now publish monthly journals. The journal heretofore known as *California Highways* has had added to its title, *and Public Works* and has been enlarged correspondingly in scope to make it the official journal of the Department of Public Works of

California. The editor is George C. Mansfield, Sacramento, Calif.

THE ENGINEERING ASSOCIATION OF MALAY has issued as a small cloth bound volume its *Proceedings* for the years 1925 and 1926. Two presidential addresses and six papers are included. Three of the papers deal with hydro-electric plants and one each with a dam, a gold mine and the economical development of a locomotive. (F. G. Coales, honorary secretary, Kuala Lumpur, Federated Malay States.)

AIR-HARDENING RIVET STEELS, by Harry A. Herschman, assistant metallurgist, U. S. Bureau of Standards, is the subject of an illustrated report of a study made to determine the applicability of different alloy steel rivets for joining armor plate. Steels containing 4 to 6 per cent of chromium and nickel were found to produce excellent rivets. Good results were also obtained with steels of lower alloy content by using in addition to chromium and nickel the elements of molybdenum and manganese. (15c. from the Superintendent of Documents, Washington, D. C.)

THE BUILDING RESEARCH BOARD of Great Britain covers a wide range of topics in its report for 1926, just made available at a price of 2s. by H. M. Stationery Office, Westminster, England, or British Library of Information, 44 Whitehall St., New York City. Under General Research the report takes up weathering, building materials and their strength, and efficiency of building from the user's standpoint—acoustics, heating and ventilation, solar radiation, condensation and fire resistant construction. In Part II, Special Investigations, there are brief sections on wood-cement mixtures, roof coverings other than tiles, waterproofing walls, reinforced glass, repairs to old painted ceilings of historical interest, and the "conversion of various waste materials to building uses."

AT THE WORLD POWER CONFERENCE held at Basel in 1926, it was suggested by M. Cerny of Czecho-Slovakia that it would be of general interest to collect information concerning the laws in force in different countries on water-power development. He suggested that the central office of the World Conference invite national committees to prepare such digests accompanied if possible by supplementary data, and that such laws be kept by the central office at the disposal of the national committees of the conference desiring such information. A report by Dr. Cerny, professor of the Polytechnic Institute at Prague, and counselor to the Minister of Agriculture of Czecho-Slovakia, covering laws pertaining to water-power development in Czecho-Slovakia and those existing in the states of Austria of which Czecho-Slovakia was composed prior to the establishment of the republic, is now available. (Paper; 6x9 in.; pp. 116, tables, line cuts in text and folding plates. 30 kroner.)

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE ABSORPTION OF SOUND BY MATERIALS—By Floyd R. Watson, Professor of Experimental Physics, University of Illinois. Paper; 6x9 in.; pp. 27; illustrated. Free on request to Engineering Experiment Station, Urbana, Ill.

Presents theory, method of measurement and conclusions of tests of specific materials.

BEMESSUNGSTAFELN FÜR EISENBETONKONSTRUKTIONEN; Tafeln zum Ablesen der Momente, der Bewehrungen für einfach und doppelt bewehrte Platten, Balken und Plattenbalken bei Verwendung von gewöhnlichem und hochwertigem Zement und Eisen bzw. Stahl, mit Berücksichtigung der Spannungen im Steg, und Tafeln für das sofortige Ablesen von Stützenquerschnitten und Bewehrungen auch bei Knickgefahr—By Baurat Paul Göldel, Beratender Bauingenieur in Leipzig. Berlin: Julius Springer. Cloth; 7x10 in.; pp. 231; bound, 22 reichmarks.

CONCRETE YEAR BOOK, 1928 [British]: A Handbook, Directory and Catalog of Concrete—Edited by Oscar Faber, O.B.E., D.Sc., M.Inst.C.E., and H. L. Childe. Editor Concrete Publications. London: Concrete Publications, 20 Dartmouth St., S.W.1. Boards, cloth back; 6x9 in.; pp. 540, including advertisements. 4s., post free.

CONSTRUCTION JOB MANAGEMENT—By Charles F. Dingman, M.Am.Soc.C.E., M.Am.Soc.M.E. New York and London: McGraw-Hill Book Company, Inc. Cloth; 4x7 in.; pp. 220; 26 line cuts. $2.50.

DRUCKVERTEILUNG ERDDRUCH, ERDWIDERSTAND TRAGFAHIGKEIT—Von. Dr.-Ing. Heinrich Pihera, Teplitz-Schönau. Vienna: Julius Springer. Paper; 6x9 in.; pp. 92; 51 line cuts in text and six plates of diagrams. 9 reichmarks in Austria.

THE ECONOMICS OF LAND RECLAMATION IN THE UNITED STATES—By Ray P. Teele, Agricultural Economist. Chicago, New York and London: A. W. Shaw Company. Cloth; 6x9 in.; pp. 337; 13 line cuts. $4.

ELECTRIC CONTROL GEAR AND INDUSTRIAL ELECTRIFICATION—By William Wilson, M.Sc., B.E., M.I.E.E., A.A.I.E.E., Author of "Small Electric Generating Set Employing Internal Combustion Engines." New York: Oxford University Press, American Branch. Cloth; 6x9 in.; pp. 361; 216 line cuts and halftones. $8.50.

Comprehensive British treatment of subject with extensive use of text and illustrations of trade catalog type, including much from General Electric Company, Ltd.

THE GAS SUPPLY OF THE MODERN CITY—By W. R. Addicks, Senior Vice-President, Consolidated Gas Company, New York City. In Lectures on Engineering Practice, 1927, School of Engineering, Johns Hopkins University, Baltimore, Md. Paper; 6x9 in.; pp. 29; halftones and folding diagrams.

HIGHWAY ENGINEERING: A Study for Students of Civil Engineering—By John H. Bateman, C.E., M.Am.Soc.C.E., Research Professor of Highway Engineering, Louisiana State University. New York: John Wiley & Sons, Inc. London: Chapman & Hall. Cloth; 6x9 in.; pp. 418; numerous halftones and line cuts. $4.

INTRODUCTORY MATHEMATICS—By Joseph E. Rowe, Ph.D., M.Am.Soc.M.E., Professor of Mathematics in the College of William and Mary, etc. New York: Prentice-Hall. Cloth; 6x9 in.; pp. 285; line cuts. $2.50.

A college textbook for freshman. According to the Preface, "the trinometer and trinometry are [here] presented for the first time in any text," as also "a general method of solving the quadratic, the cubic and the biquadratic equation." Credit for the latter is given to Prof. E. J. Oglesby.

THE LAKE PLATEAU BASIN OF THE NILE; Part II—By H. E. Hurst, D.Sc., F.R.Met.Soc., Director General, Physical Department, Egyptian Ministry of Public Works. Cairo, Egypt: Government Publications Office. Boards, cloth back; 8x11 in.; pp. 66; folding map and 51 halftone views. Price, P.T. 10.

Deals with the topography and hydrology of the part of the plateau mentioned lying in the drainage areas of the Kagera River and the rivers flowing into the south end of Lake Edward. The journey, made on foot and on bicycle, was made in 1926, in continuation of one made by Mr. Hurst in 1924 and described in an earlier publication.

MANUAL OF FIRST-ORDER TRAVERSE—By Casper M. Durgin, Hydrographer and Geodetic Engineer, and Walter D. Sutcliffe, Associate Mathematician, U. S. Coast and Geodetic Survey. Paper; 6x9 in.; pp. 133; tables, diagrams and halftones. 30c. from Superintendent of Public Documents, Washington, D. C.

Designed primarily for the engineers and mathematicians of the Coast and Geodetic Survey engaged in field work and office computations, but the methods outlined may be used by engineers outside the bureau with such modifications as local conditions require. It is a complete description of both field methods and office computation.

THE MODERN DEVELOPMENT OF CITY GOVERNMENT in the United Kingdom and the United States—By Ernest S. Griffith, D. Phil. (Oxon.); Warden, University Settlement, Liverpool; Hon. Lecturer, Liverpool University; Sometime Preceptor in Economics, Princeton University. In two volumes: Vol. I and Vol. II. New York: Oxford University Press, American Branch; London: Oxford University Press, Humphrey Milford, publisher to the University. Cloth; 6 x 9 in.; Vol. I, pp. 422; Vol. II, pp. 323. $14.

IL NUOVO PONTE SULLA PIAVE A BELLUNO—By Ing. Eugenio Miozzi. Estratto dagli Annali dei Lavori Publici, Anna 1927, Fasciola VII. Rome, Italy: Address the Author, Via Gilm, 5, Bolzano. Stiff paper; 8x11 in.; pp. 47; halftones, folding plates, line cuts in text.

Describes construction of a reinforced-concrete bridge of 71.6-meter span across the Piave at Belluno, Italy, and presents a mathematical analysis of its design.

A PHYSICAL STUDY OF THE MOKELUMNE PIPE LINE—By Lloyd T. Jones and Walter S. Weeks. University of California Publications in Engineering. Berkeley, Calif.: University of California Press. Paper; 7x11 in.; line cuts and halftones. $1.

See *Engineering News-Record*, August 4, 1927, p. 185, for article based on this study of the steel pipe line under construction for the East Bay Municipal Utility District to bring water to Oakland and other cities.

A PRIMER OF BLUE-PRINT READING—By Thomas Diamond, Associate Professor of Vocational Education, University of Michigan, Ann Arbor, Mich. Milwaukee, Wis.: The Bruce Publishing Co. Paper; 6x9 in.; pp. 70; 48c.

PRINCIPLES OF HIGHWAY ENGINEERING—By Carroll Carson Wiley, C.E., M.Am.Soc.C.E., Assistant Professor of Highway Engineering, University of Illinois. New York and London: McGraw-Hill Book Company, Inc. Cloth; 6x9 in.; pp. 510; 227 line cuts and halftones. $4.

RAILWAY SIGNALING THEORY AND PRACTICE: A Practical Manual for Engineers, Transportation Officers and Students—By S. T. Dutton, M.Inst.C.E., Late Deputy Chief Engineer, East Indian Railway. London: Crosby Lockwood & Son. Cloth; 5x8 in.; pp. 148; line cuts. 7½s. in England.

A handbook of British practice, with some notes on practice in India.

THE RISE AND FALL OF DISEASE IN ILLINOIS—By Isaac D. Rawlings, M.S., M.D.; In collaboration with William A. Evans, M.D., D.P.H., Gottfried Koehler, M.D., and Baxter K Richardson, A.B. Published by Illinois State Department of Public Health (Springfield, Ill.) in Commemoration of its Fiftieth Anniversary. Cloth; 7x10 in.; pp. 432; graphs, tables, halftones, including many portraits.

Virtually a history of state health administration in Illinois with biographical notes on members of the State Board of Health and the staff of the board, together with a review of the main topic indicated by the title of the volume—the rise and fall of disease in Illinois, naturally with relation to communicable diseases.

Letters to the Editor

A Forum for Discussion of Views of Engineers and Contractors

Sewage Settling Tank Design

Sir—In an article entitled "Study of Sewage Settling Tank Design," by C. H. Capen, Jr., published in your issue of Nov. 24, 1927, p. 833, a method is described for the determination of the ratio of the so-called flowing-through period to the time of retention. It is stated that the most efficient tank, so far as the complete utilization of settling capacity is concerned, will be one in which the value of this ratio is unity. It is further stated that this ratio is a direct measure of the economy of design of the tank. It would seem to the writer that more experimental data were required to establish the value of this analysis as a measure of the efficiency of the sedimentation process or of the economy of design of settling tanks.

The paper by Allen Hazen "On Sedimentation" (*Trans.* Am. Soc. C. E., Vol. 53, p. 54, December, 1904) indicates that there are many theoretical cases of sedimentation for which such a measure as the one proposed would give an inadequate idea of the efficiency of the process.

Let us assume two tanks of equal size and similar shape receiving water or sewage at the same rates of flow, each with an efficiency of 50 per cent, as determined by the method of Mr. Capen. Let it also be supposed that in one case the lower half of the tank is out of operation; in the other, the right half of the tank is out of operation. In the first tank the ratio of the time necessary to remove a particle of a given size to the time available for its removal might be unity; in the second tank the same ratio for a similar particle would be one-half. (The particles would have, of course, twice as far to fall in the tank of greater effective depth.) Theoretically the first tank would be somewhere between 1½ and two times as efficient as the second tank, yet as originally assumed they would have the same efficiency ratio as determined by Mr. Capen's method. (See Hazen's curves, p. 47 of the article referred to.)

Mr. Hazen points out that for a wide range of conditions the time of retention may be of no importance in sedimentation. The important factor that determines the efficiency of removal of suspended matter in a settling tank is the ratio of time necessary to time available for the deposition of a particle of a given size. This depends not merely on the time of retention (nor upon its inverse, the rate of treatment of the water in second-feet per cubic foot of volume of the tank) but rather upon the rate of water treated in second-feet per square foot of water surface in the tank.

The writer believes that the methods described by Mr. Capen may furnish valuable data concerning the action of sedimentation tanks. He suggests that an analysis based on the shape of Mr. Capen's curves might throw light upon the mixing that doubtless takes place to impair the efficiency of sedimentation. This effect is suggested in Mr. Hazen's paper, p. 49.

To sum up, the writer believes that the actual mean time of retention or the flowing-through time is of questionable importance as a factor in determining the efficiency of performance of sedimentation tanks.

WARREN E. HOLLAND,
Instructor in Civil Engineering.

Purdue University,
Lafayette, Ind., Dec. 28, 1927.

Sir—The foregoing letter from Mr. Howland indicates a keen appreciation of the theory of sedimentation and requires a careful reading of Mr. Hazen's paper referred to in order to obtain a complete understanding of the criticisms. In general, the writer agrees with the theory as explained by Mr. Hazen in this and other articles.

The difficulty lies in finding a settling tank that acts in accordance with a prearranged theory. Mr. Howland's two propositions are sound in theory, but they do not produce the expected results in actual operation. The Millville secondary tanks are an excellent example of his first proposition and the Red Bank tank nearly meets the conditions of the second. Although the design of each is faulty in some respects, data in the writer's files on tests made at the time of the observations indicate that the Red Bank tank is superior. This observation is substantiated by the efficiency rating.

If the efficiency of removal of solids is entirely dependent, as Mr. Howland suggests, on "the rate of water treated in second-feet per square foot of water surface in the tank," then some Imhoff tanks that are producing excellent results would be theoretically very poor.

There is no doubt that Mr. Howland is correct in ascribing the shape of the curves given in the original article to a mixing which impairs sedimentation and which was, as he says, suggested by Mr. Hazen. The writer has thought of several explanations at various times but has found inconsistencies which seem to defy even the most simple and plausible theory. A further study of the shape of these curves would please not only Mr. Howland but the writer as well.

On p. 71 of Mr. Hazen's article the following sentence in his final summing up is of particular interest: "In other words, the best results are obtained where any given lot of water goes through the basin with the least mixing with the water which entered before it and with the water which enters after it." This agrees with Mr. Clifford's ideas (given in the original article) and, as far as the writer can see, is entirely in harmony with the efficiency rating method.

C. H. CAPEN, Jr.,
Consulting Engineer.

East Orange, N. J., Jan. 21, 1928.

A Group of Superior Intellect

Sir—In the editorial "A Case for Counsel," I note with regret that you have definitely joined the ranks of the Bolsheviks in the engineering profession. You speak of pioneer work being required in the control of the Mississippi River. Yet the fact is that this work has been going on for nearly two hundred years; and rivers in Europe have been controlled for many centuries and in Asia for many thousands of years.

You say, "As yet not even the broad outlines of the work are known." I am firmly convinced that General Jadwin and his corps of engineers know fully what they are doing. They have been working according to carefully conceived plans and fully know what they are doing and what their predecessors have done before them.

What happened in the last flood was nothing but what had been foreseen would happen occasionally. The higher the levees are raised the more rarely will these disasters occur; but they probably cannot be entirely avoided.

The Corps of Engineers of the Army is undoubtedly one of the most capable and intelligent groups of engineers in the country. About five years ago, at the meeting of the American Society of Civil Engineers in New Orleans, the propagandists within the engineering profession raised their heads in an attempt to discredit the work of the Army engineers in the Mississippi Valley, but were put down for the time being.

But now the disastrous flood which has just occurred has rekindled the fire and stirred the emotions of the multitude who through the weight of their overwhelming numbers attempt to down and probably will succeed in downing this small group of superior intellect, one of the few remaining in our declining civilization.

Read Tacitus' history and see how in the declining days of Rome the same development took place.

X. Y. Z.

Richmond, Va.
Feb. 7, 1928.

News of the Week

Current Events in the Civil Engineering and Contracting Fields

New York Company Buys 1,000 Acres in New Jersey To Establish Garden City

Announcement has been made of the purchase of a thousand acres of land between Paterson and Hackensack, N. J., for the building of a city of some 25,000 population on the plan of the English garden cities, as notably exemplified by Letchworth. The purchase has been made by the City Housing Corporation of New York City, which within the past four years purchased and has nearly covered with residences a tract of some 50 acres, called Sunnyside, in Queens Borough, New York City, within a few minutes ride from Grand Central Station. These houses have been sold or are being rented at moderate prices. They have been financed on a limited dividend plan in conjunction with bonds secured by mortgages on the property.

The new city in New Jersey, which will be called Radburn, has been described within the last few weeks at several public meetings in New York City, including one held on Feb. 8. Besides a lantern view talk on both Sunnyside and the projected Radburn by Alexander M. Bing, president of the City Housing Corporation, the meeting was addressed by Thomas Adams, director of the Regional Plan of New York. The latter spoke on the topic, "The New Town as a Solution of the Housing Problem." His paper will be abstracted in a later issue of *Engineering News-Record*.

Self-Contained Community

Radburn is projected as a self-contained community with industrial plants and with well-designed housing facilities in a park and garden settting to provide homes for the workers within the city limits as well as for any others who wished to purchase or rent houses in Radburn.

A special feature of the layout of Radburn is the division of the residence section into units, each provided with a public school, playground and other community features which may be reached without crossing a main traffic street. From the main traffic streets of each unit there will extend short dead-end streets, abutting closely upon which will be houses with kitchens, garages and small yards on the service street front. The other side of the houses will face gardens common to two rows of the houses, with a single path leading to a park.

Clarence S. Stein, formerly chairman of the New York State Commission of Housing and Regional Planning, is chief architect of the City Housing Corporation, and with him is associated Frederick L. Ackerman. In charge of the grouping of homes and of landscape architecture is Henry Wright, chairman of the Committee on Town Planning of the American Institute of Architects.

Jones Bill Would Stabilize Employment

Senator Wesley L. Jones of Washington has introduced a bill in the Senate aimed "to stabilize industry and employment by the expansion of public works during periods of unemployment and industrial depressions." The bill appropriates $75,000,000 to aid the states in the construction of post roads, $50,000,000 for the preservation and maintenance of river and harbor works, $10,400,000 for prosecuting work of flood control and $15,000,000 for public buildings outside the District of Columbia. All the sums named are in addition to the amounts normally appropriated for such purposes.

The bill also provides that "no appropriation shall be made pursuant to the authorization contained in this act until such time as the President finds and communicates to the Congress that the volume, based upon value, of contracts awarded for construction work in the United States has fallen 20 per centum for a three-month period below the average of the corresponding three-month periods of 1926 and 1927."

Quincy, Ill., Abandons Project For Municipal Bridge

As the city of Quincy, Ill., was unable to finance its project for a municipal bridge across the Mississippi River, the city council in January passed an ordinance by which the city's permit from the U. S. War Department for the construction of the bridge would be transferred to a contracting company, subject to certain conditions. The company has 60 days in which to accept these terms.

Preliminary Permit for Power Sites in Wisconsin

A preliminary permit for the Wisconsin Power & Light Company, covering five sites within the Menominee Indian Reservation in Wisconsin, has been authorized by the Federal Power Commission. No license will be applied for until agreement regarding compensation for the use of Indian lands between the power company and the Indians has been reached. The power sites have a proposed installed capacity of 20,000 hp.

Construction Division Hears Government Criticised for Prosecution of Contractors

The ninth annual meeting of the Construction Division Association was held in New York on Feb. 10 and 11. Col. E. A. Simmons, of New York, was elected president.

The annual banquet on Saturday night was the occasion of a strong arraignment of the politicians who, for purely political reasons, had brought about the indictment of cantonment contractors and other individuals concerned with war construction work. Brig.-Gen. R. C. Marshall, Jr., after reciting the war-time achievements of the Construction Division, told about the bringing of the suits. They aggregated $60,000,000, which was more money than the contractors themselves had handled; many of the cantonment bills had been paid directly by the government. The contractors entered demurrers in these suits and a subsequent head of the Department of Justice, realizing that the government had no case, dropped all of the suits except one. This came for trial, and in the eleven days of the proceedings the government did not call to the stand a single individual who had been in a responsible position during the war. The jury was out for less than four minutes and then returned with a verdict for the contractor.

Former Senator W. M. Calder, of New York, a member of the Senate during the war, declared that the Construction Division's work had been well done and that the charges brought by the government were unfair.

The final speaker, Benedict Crowell, who was Assistant Secretary of War during the late conflict, stated that the public could never adequately acknowledge its indebtedness to the construction industry. Today, with the industry fully vindicated of the charges made against it, the industry did not want sympathy, but Harry Daugherty certainly needed it.

Avery Brundage, retiring president of the association, presided at the meetings.

Power Plant on the Savannah River Authorized

The Federal Power Commission has issued a license to the Savannah River Electric Company under which it may build a dam 90 ft. high and 4,200 ft. long on the Savannah River at a location about 222 miles above its mouth in McCormick County, South Carolina, and Columbia County, Georgia. It is expected that 120,000 hp. will be installed in the power plant ultimately.

Manual of Practice Is Discussed by New England Water Works Association

At the luncheon meeting of the New England Water Works Association in Boston, Feb. 8, the "Manual of Water Works Practice," published two years ago by the American Water Works Association, was the topic of discussion, by request of the Standardization Council of the association. In general there were numerous criticisms of poor arrangement, and especially of poor indexing, but much commendation of the material in the "Manual" as a whole. Some of the specific criticisms, with a view to improvements in the next edition, are here summarized, grouped in the general order of the main topics as they are taken up in the "Manual":

Collection — Speaking on flood discharge, H. K. Barrows suggested the inclusion of the recent Jarvis and Pettis formulas for flood runoff, but showed by examples the inconsistencies in the use of the various formulas and methods and the necessity of careful detailed studies in actual cases. A. D. Weston sounded a similar note of warning in the use of general data of watershed yield and storage effect without skilled engineering advice, although the general data in the "Manual" are excellent.

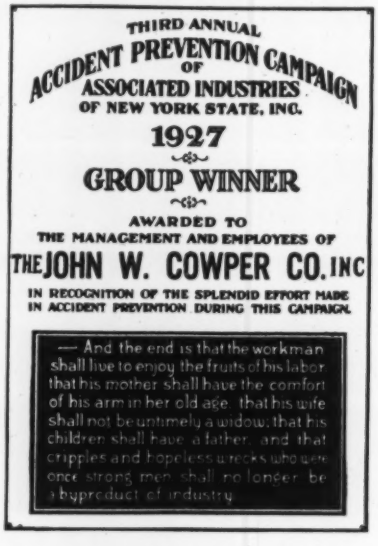
Quality and Treatment—E. Sherman Chase suggested that the value of water supply sanitation should be ascertained, as purification methods are not always fully effective and may even fail at times. Ownership of land adjacent to water supplies is an important feature and more actual data on this subject should be given. A more complete discussion of sanitary hazards, such as ice cutting, fishing, boating, etc., is desirable. R. S. Weston said that the chapter on water treatment departs too much from the "case method." The arrangement could be greatly improved by uniformity of style and method of expression. The names of makers of apparatus with descriptions should be given more fully. Space allocation should be readjusted; thus iodine treatment of water—a subject of relatively minor importance—has the same space (16 pp.), as rapid sand filtration. H. W. Clark thought the chapter on industrial wastes too short; that the location of the common types of this problem by states should be given, with typical examples of the method of eliminating pollution. It appears that 60 per cent of such troubles are due to coal-mine and coke-washing wastes.

Distribution — George H. Finneran noted that in the recent fire at Fall River, which lasted eight hours, a fire use of 26,000 g.p.m. for the first 5½ hours was required, as against 10,000 g.p.m. for a city of this size, as given on p. 300 of the "Manual."

Financing and Management—Charles W. Sherman thought this section too haphazard in its handling, with too much space given to special problems. He suggested new subdivisions as follows: Organization, Accounting, Revenue, Operating Expenses, Fixed Charges, Construction Funds, Valuation and Depreciation, Public Relations.

Contractor Honored for Perfect Accident-Prevention Record

A bronze tablet has been awarded to the John W. Cowper Company, Inc., Buffalo, N. Y., for a 100 per cent accident prevention record in building last year the new rail-mill foundations at the Lackawanna plant of the Bethlehem Steel Company. The award was made by the Associated Industries of New York State in its third annual accident-prevention campaign. This competition was held over a period of four months and there were 634 firms competing. The accompanying view shows the form of the award.


THIRD ANNUAL
ACCIDENT PREVENTION CAMPAIGN
OF
ASSOCIATED INDUSTRIES
OF NEW YORK STATE, INC.
1927
GROUP WINNER
AWARDED TO
THE MANAGEMENT AND EMPLOYEES OF
THE JOHN W. COWPER CO. INC
IN RECOGNITION OF THE SPLENDID EFFORT MADE
IN ACCIDENT PREVENTION DURING THIS CAMPAIGN
— And the end is that the workman shall live to enjoy the fruits of his labor, that his mother shall have the comfort of his arm in her old age, that his wife shall not be untimely a widow, that his children shall have a father, and that cripples and hopeless wrecks who were once strong men shall no longer be a byproduct of industry.

FACSIMILE OF AWARD

The job on which the award was earned was particularly hazardous because of the heavy work, which consisted of shovel and crane excavation, pile driving and concrete work in and around the old mill, which was in continuous operation throughout the construction. The payroll on this work was from $20,000 to $25,000 a month and the number of employees varied from 125 to 150. There were two locomotive cranes, a power shovel, a tractor crane, two locomotives, cars and concrete plant. There was not a single day of lost time due to accident or injury.

Canadian Provinces Agree on Dam at Lac Seul

Arrangements made recently by the Ontario government for the construction of a reserve dam at Lac Seul, on the English River, have been approved by the Manitoba government. The agreement, the provisions of which were not disclosed, will be signed forthwith and forwarded to the Ontario government.

New York State Architect Office Is Finally Filled; W. E. Haugaard Named

Appointment of William Edward Haugaard, of New York, as state architect—the fifth person listed as head of that office in four days—was announced on Feb. 11 by Col. Frederick Stuart Greene, New York state superintendent of public works.

The controversy of the department and professional architects' organizations assumed definite form on Feb. 8 when Sullivan W. Jones resigned as state architect. Designated acting state architects since have been Joseph W. Sinnott, Walter G. Thomas and Walter C. Longleway. All refused to accept the office.

In his letter of resignation, among other things, Mr. Jones says:

"The time has come when loyalty to my profession and adherence to the principles I hold require freedom of action. I therefore hand you my resignation to take effect immediately, that I may do everything within my power to insure defeat of the vicious legislation now pending. If the bills altering the status of the state architect and the powers and authority in matters affecting the fine arts, which the state architect inherited when the fine arts commission was put to death, become law, they will result in prostitution of the practice of architecture as a function of state government, will make a puppet of the state architect, and will throw architecture in connection with the state's vast building program into the patronage grab-bag."

Mr. Haugaard served with the federal government in designing numerous buildings in the Panama Canal Zone and as assistant constructing quartermaster during the World War. He is an instructor of architecture at Pratt Institute, New York City, from which he was graduated in 1908. He also studied in the Massachusetts Institute of Technology and in the Atelier Duquesne, at Paris.

Since 1919, Mr. Haugaard has been practicing in New York under the firm name of Haugaard & Burnham.

Toll Bridge Proposed at Niagara Falls

The Canadian Parliament will give consideration this session to a bill to incorporate the Niagara Falls Memorial Bridge Company. The bill outlines the purpose of the company to construct, maintain and operate a bridge across the Niagara River from a point near the property of the Canadian National Railways, on River Road, and the north limit of Bender St., to a point in Niagara Falls, N. Y., north of the present upper steel arch bridge. The bridge would be used for pedestrians, vehicles, carriages, electric cars or street cars, and it is proposed to charge tolls. The capital stock of the company is $1,500,000.

Arch Type Bridge Will Span Kill van Kull

Formal selection of an arch type bridge over the Kill van Kull between Port Richmond, Staten Island, and Bayonne, N. J., was made by the Port of New York Authority on Feb. 9. The commissioners took this action following recommendations submitted unanimously by the engineering staff. Comparative costs and esthetic considerations, bearing in mind the locality where the span will be built, influenced the decision in favor of the arch type.

The Port Authority directed the engineers to proceed with the preparation of detailed plans so that bids for the piers may be received in the late spring. It is estimated that the bridge, which will be the longest arch type in the world, will cost $16,000,000.

"Studies," said the engineers, "confirm previous conclusions to the effect that the arch type is less expensive than the suspension type by from $1,000,000 to $1,500,000. The greater cost of the suspension type in this case is due principally to the low and flat banks on both sides of the river and the presence of solid rock close to the surface."

Engineering Firm Enlarges Its Tokyo Branch

Enlargement of its offices in Japan to meet increasing business is announced by the H. K. Ferguson Company, engineering firm with headquarters in Cleveland. Charles Konas, one of the company's engineers, will sail from San Francisco Feb. 17 to join the Ferguson organization in Japan as assistant to W. M. Thompson, manager of the Tokyo branch office. Fourteen Ferguson engineers already are in Japan.

Other Ferguson men in Japan, several of whom are supervising work on the new Ford plant in Yokohama, are J. S. Ruble, vice-president; W. N. Thompson, Tokyo manager; T. H. Mitchell, R. W. Schlenker, H. W. Sheltz, O. W. Schroeder, C. W. Wood, J. C. Peterson, H. B. Murphy, W. A. Gleason, C. W. Alexander, J. H. Welton, D. H. Wright and J. W. Lowell.

Montreal Voters Refuse Approval to $30,000,000 Improvements

A referendum on $30,000,000 of public improvements by the city of Montreal, Jan. 16 to 19, resulted in defeat by 11,312 to 5,843 voters, or a majority of 5,469 ballots, and, as to property represented by the voters, by $207,000,000 against $192,000,000, an adverse property valuation majority of $15,000,000. Non-voters numbered 37,500, or more than twice those who voted. The property valuation of the non-voters is not given in the information at hand. The referendum is described as a "straw vote" on a proposal indefinite as to the nature of the proposed improvements. There is now talk of ordering a vote on "bylaws" for two or three "specific improvements" at the election next April.

Washington Notes

By Paul Wooton
Washington Correspondent

IT IS evident that the committee on roads of the House of Representatives is opposed to the Administration suggestion that approval of the $75,000,000 highway program be made contingent upon the retention in the revenue bill of the automobile tax. There is little doubt that a majority of the members of the committee take the position that there is no connection between the sales tax on automobiles and the authorization of the funds for federal-aid highway work. There is much doubt if the Director of the Budget really would attempt to cut the road authorization below the $75,000,000 rate, as there is every reason to believe that Congress would override the budget. Some members of the committee favor authorizing a higher rate of annual expenditures.

Hearings on the highway bill are continuing before the committtee. The bill probably will be reported to the House about March 1. Of all the witnesses who have appeared before the committee no one has advocated a reduction in the amount now being appropriated for federal aid.

BY A VOTE of 160 to 96 the House, on Feb. 10, increased the rivers and harbors item in the War Department appropriation bill from $50,000,000 to $55,884,310, thereby overriding both the appropriations committee and the bureau of the budget. The amount voted was that requested by the Chief of Engineers, which was reduced to $50,000,000 by the director of the budget.

Anticipating an effort to advance the Campbell bill at this session of Congress, Major-Gen. Harry Taylor, retired, appeared before the commerce committtee of the Senate and expressed the opinion that the passage of this legislation would add many millions of dollars to the cost of the flood-control program. The bill would handicap the government in employing its own forces in the construction of flood-control works, he said. General Taylor expressed the opinion that 90 per cent of the flood-control work would be done by contract, but the government must be free to use hired labor, he said, in order to be certain of getting the lowest possible bids.

AS this is written (Feb. 14), the Senate is debating the Walsh resolution, providing for an investigation of the electric and gas industries. Senator Walsh, of Montana, who is leading the fight for the investigation by a special committee of the Senate, declares that the reference of the investigation to the Federal Trade Commission is to put it before a jury of the industries' own selection. The opposition contends that an investigation by a special committee of the Senate during a presidential year could not be divorced from politics. Indications are that the resolution will be referred to the Federal Trade Commission.

OPPOSITION has developed to the proposal of Secretary Hoover to transfer the interior geodetic work of the Coast and Geodetic Survey to the U. S. Geological Survey, a bureau in the Department of the Interior. The reasons advanced for the change have been set forth heretofore in this correspondence.

Some friends of the Coast and Geodetic Survey take the position that it would be a mistake to transplant the interior work from the fertile field where it has prospered for more than 100 years and where it has attained a world-wide reputation. Large sums of money have been expended in the aggregate to carry out a national scheme that is of the greatest practical value to every activity that requires precise information as to geographical position or elevation.

New Tunnel Proposed Under Hudson River

A tunnel under the Hudson River, south of 60th St., Manhattan, to a point opposite in Hudson County, New Jersey, is proposed by a bill offered in the New York Legislature by Assemblyman Hofstadter of New York and in the New Jersey Legislature by Assemblyman Renner of Hoboken.

No appropriation is made in the bill for preliminary work on the tunnel, because it is believed the Port Authority will have ample means to start the work, Assemblyman Hofstadter explained. The bill provides that construction shall be financed by money raised by the Port Authority through the sale of bonds. Charges for the use of the tunnel would be pledged as security for bonds issued.

Provision is made in the bill that all connections with highways, rapid transit lines and railroads shall be subject to the approval of the Governor of the state in which the connections are located and also subject to the approval of the municipalities in which the terminals are located.

N. Y. Legislature Gets Highway Construction Program

Bills to improve highways that have been introduced in the New York Legislature by the ways and means committee of the Assembly include one appropriating $7,000,000 as the state's share of constructing rural post roads and $4,000,000 for highways on which it is inadvisable to secure federal aid; also a bill appropriating $8,071,000 for state and county highways, including bridge construction and repair of roads and bridges on Indian reservations and other special construction work; and $11,929,000, being in lieu of 10 per cent which may be retained from appropriations made for maintenance and repair of improved highways under Section 71 of the highway law.

Brief News

ACTIVE WORK IS IN PROGRESS on the Turkestan-Siberian Railroad which will connect the town of Semipalatinsk on the Omsk River in southern Siberia with the station Lugovaya on the Tashkent Railroad. The new railroad will be 1,500 kilometers long and will take approximately four years to build. It will cost in the neighborhood of 220,000,000 rubles. A delegation from the Soviet Republic has just completed purchase of power shovels and gas locomotives in the United States to be used on the construction of this railway. The road is being built primarily to reduce the grain haul between Siberia and Turkestan.

UNDER THE ARMY HOUSING PROGRAM, all the work provided for in the 1927 appropriation bill has been placed under contract. This includes 33 new barrack buildings, with a total housing capacity for 7,897 enlisted men. The 1927 bill also provides for the construction of new hospitals, with an increase of 518 beds. Under the deficiency bill for 1928, plans and specifications have been prepared for fifteen new barracks, having a housing capacity for 4,589 men. Additional hospital facilities to the extent of 224 beds are also provided under this bill.

THE LARGEST STEAM LOCOMOTIVE ever built in America has been ordered by the Northern Pacific Railway. It will be 121 ft. long and will weigh, including tender, 1,082,500 lb., or 541 tons. Its firebox will be 22 ft. 2 in. x 9 ft. 6 in., and the tender will hold 26 tons of coal and 20,000 gal. of water. It will have twenty pairs of wheels, eight pairs of which will be driving wheels. The locomotive will be used between Mandan, N. D., and Glendive, Mont., where 1 per cent grades predominate.

TWO NEW SEWERS, costing nearly $500,000, to serve the northeast section of Indianapolis have been authorized by the board of public works. The East 42d St. main sewer will be 30,512 ft. long and will cost $262,693. The 46th St. main sewer will be 23,580 ft. long and will cost $186,038.

GOVERNOR SMITH HAS SIGNED THE STONE BILL amending the New York state highway law increasing from $3,000 to $10,000 amounts of money that a town may expend in any one year for the purchase or repair of stone crushers, steam rollers, motor trucks, concrete mixers, etc.

ADDITION TO INDIANA'S HIGHWAY SYSTEM of approximately 205 miles of paved road has been approved by the Governor following a conference with members of the State Highway Commission after hearing petitions for roadway improvements in the state system from a number of delegations from various parts of the state.

Detroit Proposes Metropolitan Sewerage District

As a result of two years' controversy between Detroit and River Rouge, Mich., over the proposal of the city of Detroit to establish sewage-works in the latter place, it is now planned to abandon this project and to have legislation passed for the creation of a metropolitan sewerage district to include Detroit and about a dozen adjacent municipalities. This step was taken Jan. 25, at a meeting in Detroit of representatives of all the municipalities concerned. It is hoped thus to make one project for preventing sewage pollution of the Detroit River and to handle this project to the economic benefit of all interests.

About two years ago the city of Detroit began to acquire land in River Rouge for large sewage-works, but this plan was blocked in 1927 by the passage of a law which prohibited one community from establishing such works in another community without approval of the latter by public vote. Location of larger works farther south, on the Lake Erie shore, is now proposed, but legislation is necessary as a first step, and this may be included in a call for a special session of the Legislature. According to unofficial reports the plant on the Detroit River, with its connecting sewers, was to cost about $40,000,000, whereas the Lake Erie plant and main sewer is estimated at $80,000,000 to $100,000,000, this cost being apportioned among the several communities.

Third Midwest Power Conference Held in Chicago

The third Midwest Power Conference is being held this week, Feb. 14 to 17, in the Hotel Stevens, Chicago. The program calls for the consideration of various phases of the power situation, covering what has been and is being done in the power industry, considering also probable future developments.

Some of the addresses scheduled are: "The General Flood-Control Problems on the Mississippi System," by Gen. Edgar Jadwin; "Problems of Storage for Flood Control and for Power Development," by D. W. Mead, Madison, Wis.; "Irrigation, Flood Control and Power Development Problems on the Colorado River," by Col. W. Kelly, Buffalo, N. Y.; "The Tennessee River Survey," by Major L. H. Watkins.

Who Has One to Spare?

The files of the Public Library in New York lack a copy of *Engineering News-Record* for Sept. 28, 1922, and the librarian has asked us to appeal to our readers for a copy of this issue, as our supply is exhausted and one cannot be obtained from dealers in back issues of periodicals.

E. H. Andersen, director, the New York Public Library, will appreciate it if any reader of *Engineering News-Record* who has this issue to spare would donate it to the library.

Personal Notes

HENRY G. PERRING, supervising engineer of the Public Improvement Commission, Baltimore, has resigned to resume practice as a consulting engineer. The commission has appointed a special committee to consider his successor. In 1920 Mr. Perring became chief engineer of Baltimore and later was appointed an ex-officio member of the Public Improvement Commission. By unanimous vote of that body he was appointed supervising engineer in 1922. The administrative work on school loans totaling $21,000,000 was handled by Mr. Perring. This work has been finished with completion of the new Baltimore City College. Construction of the Baltimore stadium, raising the water level of Loch Raven dam and the erection of numerous other buildings also were among the projects he supervised.

CHARLES HENRY FOWLER, formerly of the Rust Engineering Company, of Pittsburgh, has joined the contract department of the H. K. Ferguson Company, construction engineers, of Cleveland. Mr. Fowler has done engineering work for the Fred T. Ley Company, contractors, of New York and Springfield, Mass., and for the Pittsburgh office of the Truscon Steel Company. He is a graduate of Cornell University, receiving the degree of C.E. in 1914, and is an associate member of the American Society of Civil Engineers.

C. E. SWAIN, highway engineer with the U. S. Bureau of Public Roads, who has been stationed at Nashville, Tenn., for some time, has been named assistant engineer of the Tennessee State Highway Department. Mr. Swain will take over the work on March 1, succeeding R. H. Baker, who resigned recently to accept a position as engineer-manager of the Tennessee Contractors Association.

Dr. CHARLES CAMSELL, deputy minister of the Canadian Department of Mines, was elected chairman of the Ottawa branch of the Engineering Institute of Canada at the annual meeting held recently.

GEORGE TEAL, formerly city engineer at Boulder, Colo., has been elected city manager of Boulder by the city council.

C. E. PERKINS, of Bartlesville, Okla., has been appointed superintendent of the Bartlesville Water Company, effective Jan. 1. Previously to that date Mr. Perkins, who is a graduate in civil engineering of the University of Kansas, was supervising engineer on the water company's rehabilitation program, representing the Burns & McDonnell Engineering Company, of Kansas City.

A. V. RUGGLES, of Cleveland, Ohio, has joined the engineering staff of the Community Water Service Company,

40 Cedar St., New York City. Mr. Ruggles is a graduate of Dartmouth College and during the World War, as Captain of Engineers, had charge of water-works construction and operation at St. Nazaire, France. He then became chief civil engineer of the Cleveland Water Department and had charge of design and construction of the $15,000,000 Baldwin-Fairmount project and for a portion of this period was also Commissioner of Water. For the last few years he has been special representative for the United States Cast Iron Pipe & Foundry Company on sales promotion in various parts of the country.

HARRY MORTORFF, of Kendallville, Ind., has been named by the board of county commissioners at Albion, Ind., to succeed Paul Hoffman as county surveyor. At the time of his appointment Mr. Mortorff was in a hospital at Fort Wayne recovering from a serious operation, but he expects to be able to assume his new duties soon.

JOHN W. YOST, who has been special city engineer at Shelbyville, Ind., during the past year, has been appointed city engineer for one year.

LEE JUTTON, JOHN T. KELLY and JOSEPH MCCARTY announce that they have formed the Jutton-Kelly Company, general railroad contractors, with offices in Milwaukee and Detroit. The company is a successor to the Duffy & Jutton Company.

Dr. A. A. POTTER, dean of the School of Engineering and director of the Engineering Experiment Station of Purdue University, Lafayette, Ind., has been appointed to the Land-Grant College Survey being conducted by the Bureau of Education, Department of the Interior. Dr. Potter is appointed as a consulting expert and is responsible for the classification of the functions, services and responsibilities of the land-grant colleges through their engineering colleges and divisions.

M. H. DOYNE is manager and M. C. BECK is treasurer of C. E. Smith & Company, consulting engineers, St. Louis, Mo. The business will be carried on by men who have been associated for five to twelve years with C. E. Smith, who recently became vice-president of the New York, New Haven & Hartford Railroad.

EARLE TALBOT has been elected vice-president of the Hackensack Water Company, of which company he has been secretary and treasurer since 1915.

ERNEST BOYCE, engineer for the Kansas State Board of Health and associate professor of civil engineering at the University of Kansas, has been elected president of the Kansas Engineering Society. Professor Boyce is a graduate of the Iowa State College.

W. W. CROSBY has reopened his office as consulting engineer in Coronado, Calif. He is specializing on highways, parks and traffic.

Engineering Societies

Calendar

Annual Meetings

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, Trenton, N. J.; Annual Convention, Atlantic City, N. J., Feb. 15-17, 1928.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Convention, Philadelphia, Feb. 28, 29 and March 1, 1928.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago, Ill.; Annual Convention, Chicago, March 6-8.

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Meeting, Atlantic City, May 7-10.

AMERICAN WATER WORKS ASSOCIATION, New York; Annual Convention, San Francisco, week of June 11.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION; Annual Meeting, University of North Carolina, June 25.

THE KENTUCKY ASSOCIATION OF HIGHWAY CONTRACTORS, at its recent annual convention in Louisville, elected officers as follows: President, F. W. Graham, of Pineville; first vice-president, Ashby Corum, of Madisonville; second vice-president, J. M. Perkins, of Frankfort.

THE CONNECTICUT SOCIETY OF CIVIL ENGINEERS, INC., will hold its 44th annual meeting in New Haven on Feb. 21 and 22. Among the speakers scheduled are H. B. Kinnison, district engineer, U. S. Geological Survey, Boston, Mass., on "Special Features of the New England Flood of 1927," and Gen. Edgar Jadwin on "Mississippi River Flood Control." At the Tuesday evening session there will be talks on "The Engineer and the Public Health," by Dr. C-E. A. Winslow, professor of public health, Yale Medical School, and on "The Engineer, His Mission and His Allies," by Col. Willard T. Chevalier. At the Wednesday morning meeting O. H. Ammann, chief engineer of bridges, Port of New York Authority, will speak on "Interstate Bridges Between New York and New Jersey and the Structural Features of the Hudson River Bridge at Fort Lee," and Frank W. Skinner, consulting engineer, New York City, will present a paper on "The Design, Equipment and Construction of the Holland Vehicular Tunnel."

Obituary

GEORGE VASSAR, of New York City, died on Feb. 9 after an illness of only a few days. He was about 70 years old. Mr. Vassar, who was a great-nephew of Matthew Vassar, founder of Vassar College, was, up to the time of his retirement fourteen years ago, president of the building firm of George Vassar's Son & Company. This concern, under Mr. Vassar's direction, built many structures in New York, among them the Standard Oil Building, the Charles M. Schwab mansion, the Alhambra Theater and the German Hospital.

FRED G. SIMMONS, formerly commissioner of public works in Milwaukee, died recently at his home in that city, aged 61 years. Born in St. Catherines, Ont., Canada, he moved to Denver when sixteen years old and there studied civil engineering. From 1889 until 1897 he had charge of tracks and paving for the Denver Tramway Company. In 1897 Mr. Simmons became engineer of way and structures for the Milwaukee Electric Railway & Light Company, which position he held for fifteen years. Later he was commissioner of public works for 5½ years, resigning to go into private practice. On Jan. 22, 1923, he was appointed state engineer of Oklahoma and the following year was made manager of the Contractors' Association of Northern California. Mr. Simmons was president in 1907-1908 of the American Electric Railway Engineering Association and helped organize and was a past-president of the Engineering Society of Wisconsin.

JOSHUA B. F. BREED, chief engineer of the Commissioners of Sewerage of Louisville, Ky., died on Jan. 12, aged 72 years. Mr. Breed had been connected with the commission since 1906.

D. H. FATOUT, of Indianapolis, a contractor who had constructed roads in all parts of the Middle West, died suddenly recently of heart disease at his home. He was 72 years old.

HOWARD C. BOONE, hydraulic engineer of the Southern California Edison Company, died in Los Angeles, Calif., on Feb. 5, aged 42 years. He was born in Texas and had resided in Los Angeles for the past sixteen years.

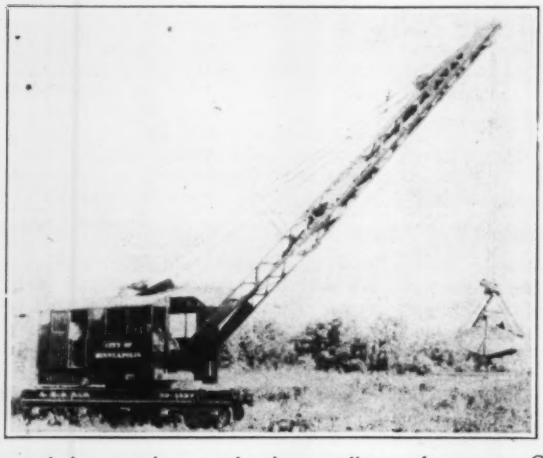
MALCOLM H. MACLEOD, consulting engineer of the Canadian National Railways, died suddenly in Toronto on Feb. 9. He was born in the Isle of Skye on July 13, 1857. In 1878 he joined the engineering staff of the Canadian Pacific and held important positions in connection with railway construction. In 1900 he became chief engineer of the Canadian Northern and was appointed general manager and chief engineer in 1907. Previously to the amalgamation of the Canadian Northern and Grand Trunk Railways in 1923 he was appointed vice-president in charge of construction, and after the amalgamation he became advisory engineer to the executive. During his service with the company more than 4,000 miles of line was constructed in the west. Mr. MacLeod prepared the original plans for the Toronto Railway viaduct, which is nearing completion.

Construction Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Three-Speed Gasoline Crane Flexible in Operation

A three-speed gasoline crane has recently been developed by the American Hoist & Derrick Co., St. Paul, Minn., which is claimed by its manufacturers to have the range and flexible operation of a steam-operated crane. In order to eliminate vibration, the four-cylinder engine is set down into the bed of the revolving deck casting. Power is applied to the point on the crane mechanism that corresponds to the crank shaft on a steam crane. The power take-off of the engine is connected to the transmission through a flexible coupling, the transmission being operated with a foot clutch and an automotive gearshift lever. The gasoline cranes can be supplied in any capacity from 12 tons up to 30. It is stated that the ratings of all these cranes are based



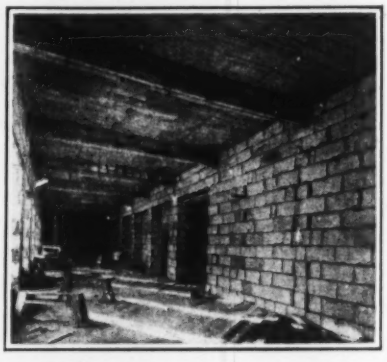
on their capacity on the intermediate gear.

Much of the smooth operation is claimed to be due to the friction clutches of the compound lever umbrella-action type which expand outwardly against the friction groove of the drum. The heads travel only a fraction of an inch to make contact and the large diameter friction groove practically eliminates any danger of over-heating.

Plaster of Paris Building Blocks From Baking Powder Waste

A new type of hollow building block is finding extensive use for non-bearing partitions in fireproof construction of large office buildings, hotels, and apartment houses. It is said also to be coming into use for sheathing purposes on frame houses on which portland cement stucco is applied. The blocks are made from an hydrous calcium sulphate waste which is a byproduct of phosphoric acid manufacture in connection with making baking powder. It is claimed that a careful chemical treatment removes all traces of the acid, and this treatment, together with physical treatment through centrifugal force exerted on the raw gypsum product, produces a strong and uniform plaster of paris. The blocks are manufactured by the Rumford Chemical Works, Providence, R. I., which has licensed two other chemical manufacturers to use its process. At the present time the company is building a plant for the recovery under this process of approximately 200 tons per day of this byproduct gypsum.

The blocks, some of which are shown in the accompanying illustration, as used in hotel construction, are 12 in. wide, 30 in. long and 2 and 3 in. in thickness. It is said that the 3-in. block is strong enough in compression and shear so that almost any height of partition can be erected. The blocks show an average of over 400 lb. per sq.in. in compression as compared to the requirements of the American Society for Testing Materials of 75 lb. per sq.in. Other tests showed that the blocks had a remarkable fire resistance quality. In the construction of the blocks reinforcement of rattan fiber is placed longitudinally. The blocks are made with a slight tongue and groove which assist greatly in alignment and ease of placement. One valuable feature of the blocks is their ability to hold nails for furring strips, etc. According to the company, it is possible to bond the



blocks with cement mortar if it is done correctly, but it is generally the custom to use calcined gypsum block setting mortar which the company makes for this purpose.

It is not customary to expose the blocks to weather conditions, but the company's manufacturing plant was used to experiment with the blocks in this connection. Blocks in this building after being exposed to the weather for twelve months showed no sign of deterioration.

Concrete Floor Placing Aided by New Reinforcing Unit

A new product for concrete floor construction designed to serve both as reinforcement and to act as a form for the concrete slab while being placed, is being

introduced by the National Steel Fabric Company, Pittsburgh, and designated as Steeltex for floors. It represents an extension of the principles of reinforcing plaster and stucco that the company has

developed in its Steeltex for plaster and Steeltex for stucco.

Steeltex for floors consists of a reinforcing mesh and a backing of sufficient strength not only to support the concrete while being poured, but to withstand the customary rough usage encountered on any construction work. The main members of the steel fabric are 12 gage wires running across the floor supports spaced 3 in. on centers having a cross-sectional steel area of 0.035 sq.in. per ft. of fabric. Secondary members are also 12 gage wire spaced 4 in. on centers with a cross-sectional area of 0.026 sq.in. per ft. of fabric.

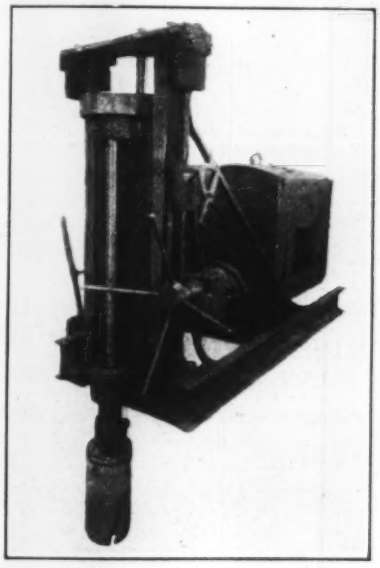
The backing is attached to the reinforcing at a distance of one-half inch from the plane of the fabric. A mastic binder in the backing insures water tightness. Steeltex comes in rolls of convenient size for handling.

Among the advantages claimed for Steeltex are the following: Elimination

of wood or metal forms; proper embedding of steel; saving in time and labor in installation; underside of backing suitable for ceiling finish; material is sound-deadening; and correct spacing of reinforcing eliminates necessity of inspector.

Core Drill Built Like a Milling Machine

A new pavement core drill has been recently developed by the H. C. Nutting Company, Elmwood Place Station, Cincinnati, Ohio, which it is claimed will take perfect right cylinder cores 6 in. diameter from concrete pavements. These true right cylinder cores are made possible by rigid construction of the machine. The entire unit is self contained and power is transmitted to the drill through a flexible coupling. Bevel and spur gears are also used in power transmission and as a reduction unit. These gears are inclosed and run

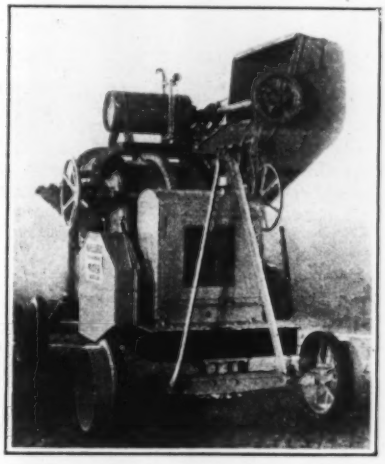


in oil. The drill spindle is mounted on a vertical slide with milling table type construction which keeps the drill spindle bearings always at the same distance from the point of work. This feature eliminates any wabbling of the shot-bit and thus a perfect core is obtained.

The drill is mounted on a steel channel frame. It is powered by a 10-12-hp., 4-cylinder Universal motor, equipped throughout with Timken roller bearings and Alemite lubrication, provided with clutch transmission between motor and drill. The drill is force feed type through a rack and pinion. It is built with the idea that it will be mounted on a 1½-ton truck.

Towing Over Both Soft and Hard Ground Aided by New Wheel

A new type of roller bearing wheel for portable concrete mixers designed to give a wide tread for soft ground haulage and a rubber tire for pavements has been announced as standard equipment on Marsh-Capron mixers. The new wheel is equipped with a steel rim 8 in. wide and 20 in. in diameter which is the proper size to receive a standard 3½-in. solid rubber tire 24-in. in outside



diameter. The steel spokes are set to one side of this rim and the rubber tire is pressed on this side so that some 4½ in. of rim projects out beyond the tire. When soft footing is encountered the tire sinks in until the full width of the rim bears on the ground.

The hub has also been redesigned in order to receive a set of Timken roller bearings. This new wheel has been developed especially to meet the demands of sewer and water-works contractors where portability is often an important factor.

Manufacturers and Trade Associations

Calendar

Annual Meetings

COMMON BRICK MANUFACTURERS ASSN., Cleveland; Annual meeting, Washington, Feb. 13-17.

CHICAGO POWER SHOW AND MID WEST ENGINEERING EXPOSITION, Chicago, Feb. 14-18.

CONCRETE REINFORCING STEEL INSTITUTE, Chicago; Annual meeting, Biloxi, Miss., March 19-21.

AMERICAN WATERWORKS MFGRS. ASSOCIATION, New York City; Annual meeting, San Francisco, Calif., June 11-14.

New Publications

Douglas Fir for Bridges—WEST COAST LUMBER TRADE EXTENSION BUREAU, Longview, Washington, has published a ten-page booklet describing Douglas fir as bridge material. Information is given on grades and strengths, including a table of recommended grades for different structural members in combination and Howe truss spans, in pile and frame trestles, and in false work. Much information is given on the preparation of Douglas fir for use in the structural grades. The working stresses for all standard grades of Douglas fir are discussed and tabulated.

For Winter Work—HAUCK MFG. CO., 126 Tenth St., Brooklyn, N. Y., has published a new bulletin, No. 2003, illustrating and describing its line of concrete heaters, thawers and oil-burning salamanders.

Steel Truss Joists—TRUSCON STEEL COMPANY, Youngstown, Ohio, has published a data book covering its open truss type steel joist. Besides a description of the joist, a discussion of its advantages for wood floor and concrete floor construction, diagrams of the joists and methods of calculation are given followed by several pages of tables of safe loads. Other important information includes drawings and discussion of construction details met with in wooden floor and concrete floor construction.

Recording Instruments—THE BRISTOL CO., Waterbury, Conn., has published a new bulletin, No. 362, on the subject of recording instruments in the power plant. The various types of charts recorded by the company's instruments are shown together with explanations as to their utility. Such instruments as recording pressure gages, indicating pressure gages, recording gages for boiler water level, for depth and volume of water, oil, etc., for feed water temperatures, flue gas temperatures, Diesel engine exhaust temperatures, and for motor and engine speeds are included.

Water Works Valves—I. C. MORRIS CORPORATION, Philadelphia, Pa., in its bulletin No. 8 discusses Larner-Johnson valves for water-works service. These valves include two types of check valves and a foot valve and the bulletin describes the use of each, including several illustrations of the valves in use. The company's free discharge regulators, as used to discharge against atmospheric pressure without conduits or pipe lines beyond the outlet end, are described. The valves range in size from 4 in. to 15 ft. outlet diameter.

Cork for Roofs—ARMSTRONG CORK & INSULATION CO., Pittsburgh, Pa., has recently published four folders of a series on the use of its corkboard for roof insulation. The folders deal with roof insulation problems in general and the company's corkboard in particular, covering such questions as insulating efficiency, practicability and cost, moisture resistance, and the relation of corkboard to fire protection.

Apron Scales—RICHARDSON SCALE CO., Clifton, N. J., has published a 28-page catalog on its apron feed automatic scales. These range in capacity from 100 lb. to 1,000 lb. The chief application for the scales is in handling coal at the power plant. A number of pages of illustrations showing the scales installed are included.

Business Side of Construction

Facts and Events That Affect Cost and Volume

Non-Ferrous Metals Drop As Steel Continues Firm

Price changes in basic building materials during the week were few and of minor importance, according to reports received by *Engineering News-Record*.

Reinforcing bars, ¾-in., at Denver warehouses are $3.83 per 100 lb., against $3.95 last week.

Several changes, mostly advances, occurred in Atlanta as follows:

	Feb. 16	Feb. 9
Cement, net, f.o.b., per bbl	2.15	$2.45
Sand, f.o.b., per ton	2.02	1.75
Lime, hydrated, finishing, per ton	25.00	21.50
Brick, delivered, per M	12.00	11.50
Hollow tile, f.o.b., per 4x12x12-in. block	0.0724	0.068

In Montreal the changes of the week are as follows:

	Feb. 16	Feb. 9
Gravel, ¾-in. f.o.b., per ton	$1.20	$1.50
Crushed stone, ¾-in., delivered, per ton	2.10	2.00
Linseed oil, raw, 5-bbl. lots, per 7½-lb. gal., f.o.b.	0.77	0.90
Common labor, non-union, per hr	0.25@0.30	0.30@0.35

In raw materials, prices of non-ferrous metals tend downward, in direct contrast with the trend in steel. Tin is at lowest level reached in the last three years. Scrap is down with the exception of certain descriptions of copper.

January unfilled orders at mills of the United States Steel Corporation were 10 per cent over those of the corresponding period in 1927. Steel ingot output in January gained 5 per cent over the first month of last year. Further improvement in buying is seen in the advance of $2 per ton on both cold-finished bars and galvanized sheets.

Week's Important Bond Offerings

Bond offerings last week were 25 per cent under those of the week before. Seven public utility issues aggregated $56,968,000. Par value of listed foreign bonds sold in the New York market in the week ended Feb. 4, 1928, totaled $26,264,000, compared with $35,867,000 in the same week of 1927. Offerings by groups follow: Public utility, $56,968,000; industrial, $32,000,000; railroad, $9,840,000; municipal, $4,105,000; Canadian, $9,866,000; foreign, $27,250,000; real estate, $4,640,000; miscellaneous, $7,000,000. Following are details on ten important issues:

		Interest Rate	Yield	Due
Government of the Argentine National	$20,000,000	5½	5.70	Aug. 1, 1962
Cleveland Union Terminals Company	5,000,000	4½	4.40	Oct. 1, 1977
International Power & Power Company of Newfoundland, Ltd.	4,866,000	5	5	Jan. 1, 1968
Louisville, Ky.	1,000,000	4	3.74	Feb. 1, 1965
Oklahoma Natural Gas Corporation	14,000,000	5	5.30	Feb. 1, 1948
Pacific Gas & Electric Company	20,000,000	5½	4.56	1957
Province of Quebec	5,000,000	4	4.15	Feb. 1, 1958
City of Rio de Janeiro	30,000,000	6½	6.75	Feb. 1, 1953
Southern Railway Company	9,840,000	4	4@4.15	Sept. 1, 1928 Mar. 1, 1943
Western Power, Light & Telephone Company	2,750,000	6	6	Feb. 1, 1948

This Week's Contracts

Heavy construction contracts reported by *Engineering News-Record* in the week ended Feb. 16, with some comparisons, total as follows:

(In Thousands of Dollars, 000 Omitted)

Week Ended	Public	Private	Total
Feb. 16, 1928	$16,946	$28,755	$45,701
Feb. 9, 1928	14,840	41,527	56,367
Feb. 17, 1927	14,594	35,503	50,097
Jan. 1 to date:			
1928	124,894	223,821	348,715
1927	97,147	222,435	319,582

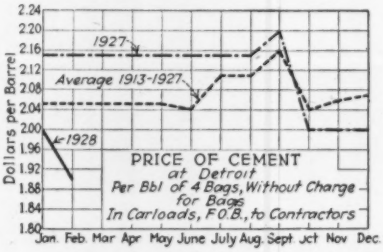
E. N.-R. Index Numbers

Cost		Volume	
Jan. 1, 1928	203.90	December, 1927	319
Dec. 1, 1927	203.90	November, 1927	272
Jan. 1, 1927	211.50	December, 1926	188
Average, 1927	206.24	Average, 1927	263
Average, 1926	208.03	Average 1926	228
1913	100.00	1913	100

No General Price Movement Seen in Detroit Cement Cut

All cement price changes of the last month were declines and occurred in Western cities—San Francisco, Wyandotte, Mich., Cincinnati and Detroit.

The recent reduction of 10c. per barrell in Detroit brings the price to a point 7 per cent below the February average for the years 1913 to 1927 and 12 per cent under a year ago. It is unlikely that prices in this particular district will move upward during the next five months, in view of the fact that that for the last fifteen years the seasonal rise has occurred in the third quarter. Detroit is located in a district where cement mills are plentiful and competition keen.



In October, 1927, when the decline started, manufacturers said it was "to provide a wider margin on all dealers' cement sales" and "to further stimulate and promote increased fall and winter building."

Business Notes

The increase from $50,000,000 to $55,860,000 in the appropriations for rivers and harbors projects in the War Department bill resulted in the House defeating the bill by a vote of 140 to 40.

The decline in automobile production reached a low figure in December but employment in the Detroit district reflects considerable improvement in the industry. The Ford Motor Company has increased the number of employees 701 during the past week. Sales have been greatly stimulated by automobile shows and generally lower prices.

The discount rate of the Federal Reserve Banks has been increased from 3½ to 4 per cent in eight districts. The Chicago district was the first to raise its rate on Jan. 25, and the Kansas City rate increase went into effect Feb. 10. Philadelphia is the only bank near New York which still has a 3½ per cent rate. The banks now having a 4 per cent rate are; Chicago, Richmond, New York, San Francisco, Minneapolis, Boston, Dallas, and Kansas City.

All commodities prices in January, 1928, were 1.8 points higher than they were one year before. The changes in points of the various groups were: farm, +14.9; food, —2; textiles, +9.5; fuels, —27.4; metals, —3.7; building materials, —11.6; chemicals, —2.1; miscellaneous, +5.1. The total change between Jan. 3 and Jan. 31, 1928, was —0.1 point caused by declines in farm and food products, and textiles; metals, building materials and miscellaneous products advanced slightly.

Trade activity as represented by bank debits is above the first five weeks of 1927. For the first week of this year the total debits reported were over 18 billion dollars and the weeks ending January 11, 18 and 25 have shown successive declines of 1, 2 and 1 billions respectively. The total for the last week of January, 1928, was about 14 billion dollars. The week ended Feb. 1, showed an increase of 1.3 million compared with the preceding week, most of which was due to larger totals for New York City.

Steel ingot production shows a higher rate of activity than last year and the last few weeks. The United States Steel Corporation is operating at about 88 per cent capacity, a decline of 1 per cent from the preceding week and 1 per cent higher than a year ago. The average rate for the independent steel companies is 2 per cent higher than last week and 1 per cent above a year ago. The increase from two weeks ago is 6 per cent for United States Steel and 8 per cent for independents. Unfilled orders for steel reported Jan. 31, 1928, by the United States Steel Corporation amounted to 4,275,947 tons which is the largest back log of orders since March, 1926.